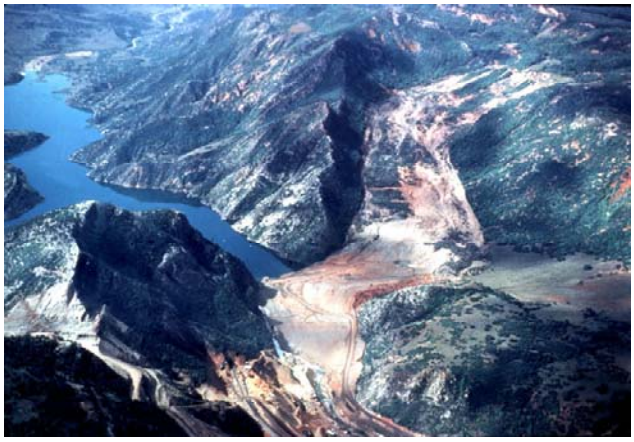
Mountainland Association of Governments

Pre-Disaster Hazard Mitigation Plan

2004



Prepared by Mountainland Association of Governments

Executive Summary

Purpose

To fulfill federal, state, and local hazard mitigation planning responsibilities; to promote pre and post disaster mitigation measures, short/long range strategies that minimize suffering, loss of life, and damage to property resulting from hazardous or potentially hazardous conditions to which citizens and institutions within the state are exposed; and to eliminate or minimize conditions which would have an undesirable impact on our citizens, the economy, environment, and the well-being of the state of Utah. This plan is an aid in enhancing city and state officials, agencies, and public awareness to the threat that hazards have on property and life and what can be done to help prevent or reduce the vulnerability and risk of each Utah jurisdiction.

Scope

Utah PDM Planning phase is statewide. The State of Utah will work with all local jurisdictions by means of the seven regional Association of Governments. The Mountainland Association of Governments area, which covers the counties of Summit, Utah and Wasatch, will have a plan completed by November 1, 2004 to give to the Utah Division of Emergency Services. Future monitoring, evaluating, updating and implementing will take place as new incidents occur and or every three to five years and will be included in the local mitigation plans as well. Natural hazards addressed are: Flooding; Wildland Fire; Landslide/Problem Soils; Earthquake; Drought; Severe Weather/Avalanche; and Infestation.

The Counties, Cities and Towns of the three-county Mountainland area are:

Summit County

Coalville, Francis, Henefer, Kamas, Oakley, and Park City.

Utah County

Alpine, American Fork, Cedar Fort, Cedar Hills, Eagle Mountain, Elk Ridge, Genola, Goshen, Highland, Lehi, Lindon, Mapelton, Orem, Payson, Pleasant Grove, Provo, Salem, Santaquin, Saratoga Springs, Spanish Fork, Springville, Vineyard, and Woodland Hills.

Wasatch County

Charleston, Heber, Midway, and Wallsburg.

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Part I
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General Regional Data

Introduction

The State of Utah is vulnerable to natural, technological, and man-made hazards that have the possibility of causing serious threat to the health, welfare, and security of our citizens. The cost of response to and recovery from potential disasters can be lessened when attention is turned to mitigating their impacts and effects before they occur or re-occur.

What is Hazard Mitigation

Hazard mitigation is defined as any cost-effective action(s) that have the effect of reducing, limiting, or preventing vulnerability of people, property, and the environment to potentially damaging, harmful, or costly hazards. Hazard mitigation measures, which can be used to eliminate or minimize the risk to life and property, fall into three categories. First; those that keep the hazard away from people, property, and structures. Second; those that keep people, property, and structures away from the hazard. Third; those that do not address the hazard at all but rather reduce the impact of the hazard on the victims such as insurance or grants. This mitigation plan has strategies that fall into all three categories.

Hazard mitigation measures must be practical, cost effective, and environmentally and politically acceptable. Actions taken to limit the vulnerability of society to hazards must not in themselves be more costly than the value of anticipated damages.

The primary focus of hazard mitigation actions must be at the point at which capital investment decisions are made and based on vulnerability. Capital investments, whether for homes, roads public utilities, pipelines, power plants, chemical plants or warehouses, or public works, determine to a large extent the nature and degree of hazard vulnerability of a community. Once a capital facility is in place, very few opportunities will present themselves over the useful life of the facility to correct any errors in location or construction with respect to hazard vulnerability. It is for these reasons that zoning ordinances, which restrict development in high vulnerability areas, and building codes, which insure that new buildings are built to withstand the damaging forces of hazards, are the most useful mitigation approaches a city can implement.

Previously, mitigation measures have been the most neglected programs within emergency management. Since the priority to implement mitigation activities is generally low in comparison to the perceived threat, some important mitigation measures take time to implement. Mitigation success can be achieved, however, if accurate information is portrayed through complete hazard identification and impact studies, followed by effective mitigation management. Hazard mitigation is the key to eliminating long-term risk to people and property living in Utah from hazards and their effects. Preparedness for all hazards includes response and recovery plans, training, development, management of resources, and the need to mitigate each jurisdictional hazard.

The State Division of Emergency Services and Homeland Security (DESHS) have identified the following hazards to be analyzed by each county. These hazards include avalanche, dam failure, debris flow, drought, earthquake, flood, flash flooding, infestation, landslide, problem soils, summer storm, tornado, urban and rural fires, and winter storm.

This regional/multi-jurisdictional plan evaluates the impacts, risks and vulnerabilities of natural hazards in a jurisdictional area affected by a disaster. The plan supports, provides assistance, identifies and describes mitigation projects for each annex. The suggestive actions and plan implementation for local and tribal governments could reduce the impact of future disasters. Only through the coordinated

partnership with emergency managers, political entities, public works officials, community planners and other dedicated individuals working to implement this program was it accomplished.

To develop the mitigation plan, The Utah DESHS, based on the Governor's Office of Planning and Budget, the Utah League of Cities and Towns, and the U.S. Department of Housing and Urban Development, chose to use the planning services of the Utah Association of Governments.

Seven regional Associations of Government:

Bear River Associations of Government
Wasatch Front Associations of Government / Wasatch Front Regional Council
Mountainland Associations of Government
Six County Associations of Government
Southeast Utah Associations of Government
Southwestern / Five County Associations of Government
Uintah Basin Associations of Government

Purpose
{tC "Purpose " \l 5}

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Wasatch County {tc "Wasatch County " \l 5}

Charleston, Heber, Midway, and Wallsburg.

Authority

Federal: Public Law 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires the identification, evaluation, and mitigation of hazards as a prerequisite for state receipt of future disaster assistance outlays. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. When PL 93-288 was amended by the Stafford Act, several additional provisions were also added that provide for the availability of significant mitigation measures in the aftermath of Presidential declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

President Clinton signed the Disaster Mitigation Act of 2000 into Law on October 30, 2000. Section 322, defines mitigation planning requirements for state, local, and tribal governments. Under Section 322 States are eligible for an increase in the Federal share of hazard mitigation (HMGP), if they submit for approval a mitigation plan, which is a summary of local and/or regional mitigation plans, that identifies natural hazards, risks, vulnerabilities, and describes actions to mitigate the hazards risks and vulnerabilities in that plan.

State: The Governor's Emergency Operation Directive, The Robert T. Stafford Disaster Relief and Emergency Assistance Act, amendments to Public Law 93-288, as amended, Title 44, CFR, Federal Emergency Management Agency Regulations, as amended, State Emergency Management Act of 1981, Utah Code 53-2, 63-5, Disaster Response Recovery Act, 63-5A, Executive Order of the Governor, Executive Order 11, Emergency Interim Succession Act, 63-5B.

Local: Local governments play an essential role in implementing effective mitigation, both before and after disaster events. Each local government will review all damages, losses and related impacts to determine the need or requirement for mitigation action and planning whenever seriously effected by a disaster, or when applying for state or federal recovery assistance. In the counties and cities making up the MAG Region, the local executive responsible for carrying out plans and policies are the County Commissioners/Council Members and City Mayors. Local Governments must be prepared to participate in the post disaster Hazard Mitigation Team process and the pre-mitigation planning as outlined in this document.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act) and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

Introduction to Region

Geography

The area's geography is quite varied with desert to the far west and high mountains in the east. The bulk of the population is found in the fertile valleys lying between mountains. Agricultural land supports mainly fruit orchards, some cattle and sheep ranches, grain farms, dairies, hogs, chickens and smaller individual farms. Pine clad slopes and oak brush foothills characterize much of the undeveloped mountain landscape that exists in the area. Development encroachment of hillsides is of real concern to environmentalists, planners, wildlife managers and fire marshals. Only a small percentage of the area's unincorporated land has been developed; however, a widespread feeling exists among planners, community leaders, and many residents that the preservation of open space within urban settings is very crucial to quality of life and community well being.

Population

The Mountainland area is comprised of three counties located in north central Utah having a combined population of 413,487 residents. Utah County, with 89% of the district's population (368,536), supports the bulk of the area's business activity which is largely driven by commerce and trade in the Lehi-Orem-Provo-Springville urban area. Just to the northeast of Utah County lies Wasatch County with a 2000 population of 15,215 persons. Heber City (pop. 7,291) is the prominent jurisdiction in the county from a size and business activity standpoint, partially because it is the county seat and lies at the crossroads of Wasatch County's two major highways, 40 and 189. To the north of Wasatch County lies Summit County with a 2000 population of 29,736 persons. Summit County is home to world famous Park City (pop. 7,371) and its ski resorts but also includes a number of smaller rural communities and pockets of unincorporated homes, cabins, farms and working ranches. Over half (58%) of the population in Summit County lives in the unincorporated area. A map of the area appears on the following page.

According to the 2000 Census, the Mountainland area encompasses 5,050 square miles of geography but, as discussed earlier, the population is mostly confined to incorporated areas.

Population Distribution in the Mountainland Region

	% Urban	%Rural	%Farm
Summit County	28.8	71.2	2.8
Wasatch County	47.4	52.6	1.8
Utah County	92.9	7.1	0.6
Mountainland Region	87.8	12.1	0.7

Source: *2001 Utah Agricultural Statistics*, Utah Department of Agriculture and Food Annual Report, State of Utah, 2001, p. 31. (2000 Census information will be available in the late fall of 2002.)

The resident population of the Mountainland Area has increased steadily since the last census was taken. The region, in 2000, showed an overall population of 413,487 residents, nearly 90% of which live within the boundaries of Utah County. With an annual growth rate of over 2.5% projected through the year 2020 for the region, the area ranks high in population growth compared to almost anywhere else in the United States. An interesting statistic generated by the State of Utah suggests that annual employment growth for the region hovers right at 3% for the same time period, suggesting a possible decrease in the already low unemployment rate, or a significant increase of in-migrating workers to fill the jobs becoming available. A third scenario could be a change in the mix of those in the workforce to include a number from the ranks of those not currently seeking employment, like the elderly, or possibly spouses not now working. Chances are good that the actual reason for the change will be a combination of all three possibilities.

Population by Race and Hispanic Origin
Mountainland Counties, 2000 (most recent available)

	White	Black	Amer. Indian Aleut, Eskimo	Asian or Pac. Isle	Hispanic	% Minority Pop
Summit	27,299	72	91	298	2,406	10.5
Utah	340,388	1,096	2,206	6,039	25,791	10.3
Wasatch	14,549	33	65	60	775	6.4
Region	382,236	1,201	2,362	6,397	28,972	10.2

Source: US Census Bureau, Census 2000

Mountainland Region Population By County and Multi-County District 1980-2030

MCD/ County	1980	1990	2000	2005	2010	2015	2020	2030	AARC 2000-2030
Mountainland	236,827	289,197	413,487	482,023	567,921	650,065	701,258	792,953	2.19%
Summit County	10,198	15,518	29,736	35,162	41,988	49,462	56,001	68,474	2.82%
Utah County	218,106	263,590	368,536	428,156	503,039	573,608	615,480	689,586	2.11%
Wasatch County	8,523	10,089	15,215	18,705	22,894	26,995	29,777	34,893	2.81%

Sources: http://www.governor.state.ut.us/projections/EDPT3.pdf;
U.S. Bureau of the Census; Utah Population Estimates Committee;
2002 Baseline Projections, Governor's Office of Planning and Budget, UPED Model System.
Notes: AARC is average annual rate of change. 1980 and 1990 populations are April 1 U.S. Census modified age, race and sex (MARS) populations; 2000 populations are April 1 U.S. Census summary file 1 (SF1) populations; all others are July 1 populations.

Economy

The economy of the area could be characterized as moderate in some sectors, but with several real concerns and challenges to be addressed. The first is the fact that the region has a very low per capita income level. Large families and low pay scales make for a somewhat unique situation which forces skilled labor out of the area, or in many cases, a second wage earner (usually the spouse) takes a low paying, low skill job to help make ends meet. There is a sense that underemployment is a related problem, although trying to measure underemployment is difficult and the usual data providers do not disseminate the numbers if they are tracked. The sense of home and community is strong in Utah and many seem willing to find alternate, less fulfilling employment rather than moving out of state for better positions.

Another challenge to the economy is the uneven distribution of businesses within the district. Utah County mostly drives the region's labor statistics, especially within the Provo-Orem geographical area; however, other parts of the district don't share much in this business boom. Smaller outlying communities in Summit and Wasatch County, and even southern Utah County, may be struggling to find new business growth and don't share in the prosperity of the sales activity and tax distribution of their neighbors. In other words, the district may experience a 4.9% unemployment rate, but a small rural town might struggle with a 10% or higher rate, taking little comfort in knowing the region is doing so well! With 57% of all labor force non-agricultural jobs showing up in the service and retail trade sectors, there is plenty of cause for concern in the future when the demand for such services could wane because personal spending is curtailed. The regional economy has moved forward in many important ways since district designation twenty-two years ago, but further diversification and balance in the types of jobs available within the region would certainly better stabilize the economy to some extent so that in a downturn, large layoffs and reductions in lower paying jobs would not affect so many workers.

The University of Utah's Bureau of Economic and Business Research publishes a report summarizing the economies of each of Utah's twenty-nine (29) counties. Excerpts of that study are shown in each county's section of the Plan to direct some focus on the economic growth that each Mountainland county has experienced in recent years. It shows a fairly substantial rise in income and sales in each case although there may be some signs of slowing, especially in Utah County, where new residential construction seems to be tapering off compared to preceding years. Some slowing of the region economy is likely to occur during the following decade, especially with the events of 9/11, the tech stock bust, corporate corruption and war with Iraq.

Part II
Plan Pre-Requisites

Prerequisite–Resolution by each Jurisdiction

The following table denotes the plan adoption status for all jurisdictions within the MAG Region. Following the table is an example of the adoption resolution. The Appendix contains copies of all adopted resolutions.

MOUNTAINLAND AOG
STATUS OF INDIVIDUAL COMMUNITY
PRE-DISASTER HAZARD MITIGATION ADOPTION RESOLUTION

Community	No Action	In Process	Completed / Not yet adopted	Completed and adopted
Alpine				
American Fork				
Cedar Fort				
Cedar Hills				
Charleston				
Coalville				
Eagle Mountain				
Elk Ridge				
Francis				
Genola				
Goshen				
Heber				
Henefer				
Highland				
Kamas				
Lehi				
Lindon				
Mapleton				
Midway				
Oakley				
Orem				
Park City				
Payson				
Pleasant Grove				
Provo				
Salem				
Santaquin				
Saratoga Springs				
Spanish Fork				
Springville				
Summit County				
Utah County				
Vineyard				
Wallsburg				
Wasatch County				
Woodland Hills				

RESOLUTION NO. _____

A RESOLUTION ADOPTING THE MOUNTAINLAND ASSOCIATION OF GOVERNMENTS PRE-DISASTER HAZARD MITIGATION PLAN AS REQUIRED BY THE FEDERAL DISASTER MITIGATION AND COST REDUCTION ACT OF 2000.

WHEREAS, President William J. Clinton signed H.R. 707, the *Disaster Mitigation and Cost Reduction Act of 2000,* into law on October 30, 2000.

WHEREAS, the Disaster Mitigation Act of 2000 requires all jurisdictions to be covered by a Pre-Disaster Hazard Mitigation Plan to be eligible for Federal Emergency Management Agency post-disaster funds,

WHEREAS, Mountainland Association of Governments (MAG) has been contracted by the State of Utah to prepare a Pre-Disaster Mitigation Plan covering all of the jurisdictions in the MAG Area, and

WHEREAS, the MAG Executive Council approved MAG Staff to write the plan on February 21st 2002, and

WHEREAS, _____City is within the MAG Area, and

WHEREAS, the _____ City Council is concerned about mitigating potential losses from natural disasters before they occur, and

WHEREAS, the plan identifies potential hazards, potential loses and potential mitigation measures to limit loses, and

WHEREAS, the _____ City Council has determined that it would be in the best interest of the community as a whole to adopt the Pre-Disaster Hazard Mitigation Plan as it pertains to the City, therefore

BE IT RESOLVED BY THE _____ CITY COUNCIL THAT:

The attached "Mountainland Association of Governments Pre-Disaster Mitigation Plan" be adopted to meet the requirements of the Disaster Mitigation and Cost Reduction Act of 2000.

This Resolution shall be effective on the date it is adopted.

DATED this _____ day of _____, 2004.

Part III
Planning Process

Part III Planning Process

The Pre-Disaster Mitigation Plan process was presented to the MAG Executive Council (with elected officials for every jurisdiction) in early 2002. The Executive Council unanimously approved the process, which designated MAG staff (Andrew K. Jackson, Andrew Wooley, Jill Stark) to prepare a multi-jurisdictional plan for adoption by each community. A written invitation was sent to the Mayor of every community requesting participation in the planning process.

An Ad-Hoc Disaster Mitigation Plan Steering Committee was created to determine which hazard were applicable, to provide historical background, develop mitigation strategies and to review the draft plan. Letters were sent out to the mayors of each community requesting that they have someone attend the meetings. Committee Meetings were held on the fourth Thursdays of each month starting in early 2003 until the plan was completed. Approximately twenty of the thirty-six jurisdictions were represented at meetings. Nearly 70% of the total population of the area was represented at at least one meeting. Agendas of Ad-Hoc Committee Meetings are located in the appendix.

Table 3.1 Ad-Hoc Disaster Mitigation Plan Steering Committee

Name	Organization
Andrew K. Jackson, AICP	Mountainland Association of Governments
Andrew J. Wooley	Mountainland Association of Governments
Bonnie Lewis	Mountainland Association of Governments
Jill Stark	Federal Highway Administration
Alan Wakefield	Woodland Hills City Emergency Services
Craig Searle	Utah County Public Works
Dave Bennett	Utah County Sheriff's Office
Don Peterson	Lindon City Public Works
Don Thomas	Spanish Fork City Public Works
Howard Denny	American Fork City Engineering/Public Works
Jim Hewitson	Lehi City Public Works
Kevin Callahan	Summit County Public Works
Lloyd Evans	Park City Emergency Services
Matt Schmidlein	Provo City Project Impact
Rae Prescott	Francis City Council
Robert DeKorver	Eagle Mountain Emergency Services
Scott Kettle	Kamas and Francis Cities' Engineer
Seth Perrins	Orem City Emergency Planning
Stewart Lamb	Wasatch County Planning Department
Tricia Porter	Provo City Emergency Planning

Table 3.2 Ad-Hoc Disaster Mitigation Plan Steering Committee by Jurisdiction

Jurisdiction	Representative
Alpine	Written Comment
American Fork	Howard Denny
Cedar Fort	Utah County Sheriff
Cedar Hills	Written Comment
Charleston	Wasatch County
Coalville	Summit County
Eagle Mountain	Robert DeKorver
Elk Ridge	Utah County
Francis	Rae Prescott
Genola	Utah County Sheriff
Goshen	Utah County Sheriff
Heber	Written Comment
Henefer	Summit County
Highland	Written Comment
Kamas	Scott Kettle
Lehi	Jim Hewitson
Lindon	Don Peterson
Mapleton	Written Comment
Midway	Written Comment
Oakley	Summit County
Orem	Seth Perrins
Park City	Lloyd Evans
Payson	Written Comment
Pleasant Grove	Written Comment
Provo	Tricia Porter
Salem	Written Comment
Santaquin	Mountainland Association of Governments
Saratoga Springs	Written Comment
Spanish Fork	Don Thomas
Springville	Written Comment
Summit County	Kevin Callahan
Utah County	Craig Searle, Dave Bennett
Vineyard	Orem City
Wallsburg	Wasatch County
Wasatch County	Stewart Lamb
Woodland Hills	Alan Wakefield

Notice given to smaller communities–Some smaller communities did not have staff available to attend the ad-hoc meetings. These communities were given opportunities to participate by reviewing minutes and the draft plan on the web and making comments either in writing, e-mail or over the phone. These communities are listed in the table above as being represented by written comment. Other small communities contract with either the Sheriff's Office or other larger communities for Emergency Services. Since these communities would not be responding to events themselves, they were represented by the agency that actually knows the hazard needs of the community the best. These communities are listed above as being represented by another agency or jurisdiction.

Web Site–Information on the plan and the planning process was also available on MAG's web site. Interested parties could e-mail comments on the draft plan from the web site.

A concerned citizen identifies the location of her home as she reviews Dam Failure Map at Open House.

Open Houses–An Open House was held on October 22, 2003, in conjunction with a Transportation Open House. Over 250 people attended the Open House. There were also Public Hearings held in each of the counties covered by the plan.

Identifying Hazards–Mountainland Association of Governments identified several hazards that are addressed in the Hazard Mitigation Plan. The hazards were identified through a process that included input from the Plan Steering Committee, public input, researching past disasters and Geographic Information System (GIS) data.

A Pre-Disaster Mitigation Workbook was completed for Summit, Utah and Wasatch Counties by each counties' emergency manager. This workbook covers hazard identification and mitigation for communities within the county.

The State Division of Emergency Services has a list of all declared disasters in the state (1983, 1984, 1996, and 1999). The list was reviewed by the Plan Steering Committee and then modified to more closely reflect the experiences of Steering Committee members. Mountainland AOG also has a very sophisticated GIS that was used to overlay current development with hazard data. This data was used to identify which hazards had the greatest risk within the MAG area. These hazards were then presented in greater detail in the following county portions of this plan.

Part IV
Risk Assessment

Part IV Risk Assessment

Hazard Identification and Definitions

Identifying Hazards–Mountainland Association of Governments identified several hazards that are addressed in the Hazard Mitigation Plan. The hazards were identified through an extensive process that included input from the Plan Steering Committee, public input, researching past disasters and Geographic Information System (GIS) data.

The following table 4.1 identifies the hazards

Hazard	How Identified	Why Identified
Flood	• Review of Past Disasters • Review of FIRMs • Analysis of NSFHA by Army Corps of Engineers • Steering Committee Input • State database • GIS • Public Input	• Most Frequent Hazard • Historically Highest Cost • Readily available data • Successful Mitigation
Wildland Fire	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Ever-present Danger • Current Development Patterns Increase likelihood • Historic Data • Potential Loss of Life • 90% Human Caused
Landslide/Problem Soils	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Ever-present Danger • Current Development Patterns Increase likelihood • Historic Data • Recent Losses
Earthquake	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Potential • Public Awareness • Need for Preparation • Possible High Cost • Potential Increases with Time
Drought	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Potential • Public Awareness • Historic Data • Recent Losses
Severe Weather/Avalanche	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• High Frequency • Public Awareness • Successful Mitigation • Historic Data • Recent Losses

Infestation	• Review of Past Disasters • Steering Committee Input • State database • GIS • Public Input	• Historic Data • Public Awareness • Recent Events with crickets and West Nile Virus

Profiling Hazard Events

To provide more specific detailed information, the plan has been broken down into separate sections by county. These separate sections deal with *Profiling Hazard Events*, and *Assessing Vulnerability* in greater detail.

Hazard specific research and Vulnerability Methodology

MAG collected data and compiled research on nine hazards: dam failure, earthquake, flooding, slope failure, and wildfire. Research materials came from a variety of agencies including DES, AGRC, USGS, USACE, UGS, UFFSL, county GIS, city GIS, County Assessors, and County Emergency Managers. Historical data used to define historic disasters was researched through local newspapers, interviewing residents, local knowledge derived through committee meetings, historic state publications, Utah Museum of Natural History, and recent and historic scientific documents and studies.

Vulnerability Methodology

Geographic Information Systems (GIS) were used as the basic analysis tool to complete the hazard analysis for this plan. For most hazards a comparison was made between digital hazard data and census 2000 demographic information. The Utah County recorders office provided a parcel shapefile with all pertinent assessment information. Fortunately digital data exist statewide for landslides, quaternary faults, wildfire, dam locations, and epicenter locations. County level data is available for Jordanelle and Deer Creek dam failure impact. The goal of the vulnerability study is to estimate the number of homes, and infrastructure vulnerable to each hazard and assign a dollar value to this built environment. To this end, census data and natural hazard maps are the basic information used in the analysis. All the analysis takes place within the spatial context of a GIS. With the information available in spatial form, it is a simple task to overlay the natural hazards with census data to extract the desired information.

Earthquakes

HAZUS MH shorthand for Hazards United States Multi-Hazard was used to determine vulnerability as it relates to seismic hazards for the study area. The HAZUS-MH Earthquake Model is designed to produce loss estimates for use by federal, state, regional and local governments in planning for earthquake risk mitigation, emergency preparedness, response and recovery. The methodology deals with nearly all aspects of the built environment, and a wide range of different types of losses. Extensive national databases are embedded within HAZUS-MH, containing information such as demographic aspects of the population in a study region, square footage for different occupancies of buildings, and numbers and locations of bridges. Embedded parameters have been included as needed. Using this information, users can carry out general loss estimates for a region. The HAZUS-MH methodology and software are flexible enough so that locally developed inventories and other data that more accurately reflect the local environment can be substituted, resulting in increased accuracy.
Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainty in loss estimates produced by the HAZUS-MH Earthquake Model, possibly *at best* a factor of two or more.

The methodology has been tested against the judgment of experts and, to the extent possible, against records from several past earthquakes. However, limited and incomplete data about actual earthquake damage precludes complete calibration of the methodology. Nevertheless, when used with embedded inventories and parameters, the HAZUS-MH Earthquake Model has provided a credible estimate of such aggregated losses as the total cost of damage and numbers of casualties. The Earthquake Model has done less well in estimating more detailed results - such as the number of buildings or bridges experiencing different degrees of damage.

Such results depend heavily upon accurate inventories. The Earthquake Model assumes the same soil condition for all locations, and this has proved satisfactory for estimating regional losses. Of course, the geographic distribution of damage may be influenced markedly by local soil conditions. In the few instances where the Earthquake Model has been partially tested using actual inventories of structures plus correct soils maps, it has performed reasonably well.

Landslides and Wildfire

The methodology used to determined vulnerability for landslides and wildfire within the study area was almost identical. Demographic information from census 2000 was manipulated to obtain vulnerability numbers. The methodology used, assumes and even distribution of built housing across the county and each city within the county. Assuming even distribution a housing density was determined by dividing the total number of homes (census 2000) by the total number of acres.

From this point the number of acres of extreme, high, and moderate wildfire along with acres of historically active landslides was determined for each city and the unincorporated county and then analysis was done to find affected households, employment and utility infrastructure.

Transportation and utilities information was determined using the Geoprocessing Wizard an extension in ArcView 3.2. This extension allows the GIS user to clip one theme based on another. For example the roads theme was clipped by the landslide theme, resulting in a new shape file containing all of the roads within a historically active landslide area. The new database was then queried through several simple equations to determine the length in miles of each linear feature (pipelines, electric lines, and roads). Once the length of vulnerable infrastructure was determined it was multiplied by cost estimate information from HAZUS MH and the Utah Department of Transportation. These costs include:

Table 4.2 Costs

Item	Cost per Mile
Local Roads	2,000,000
State Highways	2,413,500
US Highways	2,413,500
US Interstates	3,600,000
Power Lines	48,280
Gas Lines	241,390

In addition to the linear features point data such as critical facilities, dams, care facilities, schools, power generation facilities, and substations were analyzed to determine if the feature was within a hazard area. Where point data was determined to be within a hazard area the following values from HAZUS MH were assigned:

Table 4.3 Additional Costs

Item	Cost per Mile
Small Power Plant	100,000,000
Large Power Plant	500,000,000
Low Voltage Substation 115 KV	10,000,000
Medium Voltage Substation 230 KV	20,000,000
Large Voltage Substation 500 KV	50,000,000
Facility value was	

assigned based on Square footage.	

Limited availability of digital data represented a problem in completing the vulnerability assessment. Additional limitations to the above described analysis method includes:

Assuming random distribution
Limited data sets for water, gas, electrical, resulting in, incomplete numbers for these features.
Lack of digital parcels data from the Wasatch and Summit County Assessor's offices.
HASUZ MH is not designed for small population counties.
Relied on state wide data not intended for manipulation at the scale it was used.
Data was not field checked, resulting in an analysis wholly dependent on accuracy of data.
Meta data was lacking on some of the used data sets.

In terms of hazard mapping presentation in this document, simple, letter size maps were created to provide a graphical illustration of location. Larger maps can be plotted out upon request. Data manipulation and maps were created as a planning tool, to be used, by interested persons within Utah, Wasatch and Summit Counties in Utah. This information should not take the place of accurate field verified mapping from which ordinances need to be based off of. Owners of critical facilities should, and in most cases do, have detailed pre-hazard mitigation plans for their specific facilities.

Effort to analyze hazards related to potential future development areas was also addressed where applicable. This proved to be a very difficult exercise and at best can only identify areas, which need additional research before development should be allowed.

The following table identifies the recurrence and frequency of hazards in Utah

Table 4.4 Probability

Hazard	Number of Events	Years in Record	Recurrence Interval (years)	Hazard Frequency and Probability/Year
Droughts	17	103	6.06	0.17
Earthquakes	30	133	4.43	0.23
Landslides	1	26	26.00	0.04
Floods	275	53	0.19	5.19
Tornadoes (all)	529	120	0.23	4.41
High wind	50	30	0.60	1.67
Windstorms	839	53	0.06	15.83
Severe Winter Storms	40	41	1.03	0.98
Wildfires	1,102	10	0.01	110.20
Urban Interface Fires	Unknown	Unknown	Unknown	Unknown
Volcanoes	700	5,000,000	7142.86	0.00
Thunderstorms and Lightning (fatalities)	53	19	0.36	2.79

Flooding

Flooding is a temporary overflow of water onto lands not normally inundated by water producing measurable property damage or forcing evacuation of people and vital resources. Floods frequently cause loss of life; property damage and destruction; damage and disruption of communications, transportation, electric service, and community services; crop and livestock damage and loss, and interruption of business. Floods also increase the likelihood of hazard such as transportation accidents, contamination of water supplies, and health risk increase after a flooding event.

Several factors determine the severity of floods including rainfall intensity, duration and rapid snow melt. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can also result in flooding at locations where the soil has been previously saturated or if rain concentrates in an area having, impermeable surfaces such as large parking lots, paved roadways, or post burned areas with hydrophobic soils. Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative ground cover.

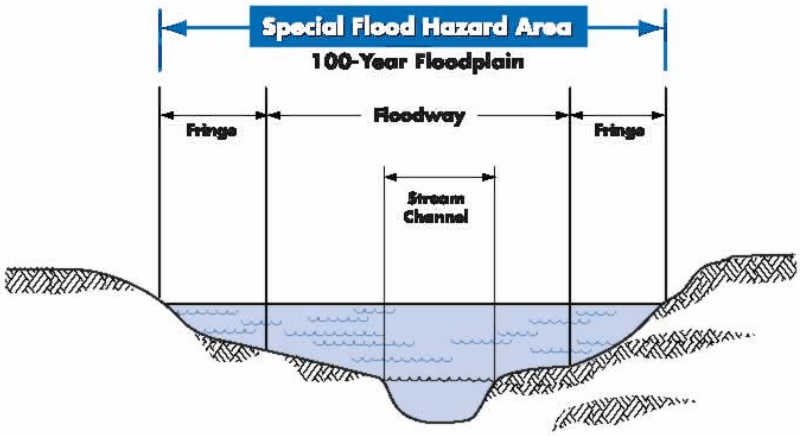
Frequency of inundation depends on the climate, soil, and channel slope. In regions where substantial precipitation occurs during a particular season or in regions where annual flooding is due to spring melting of winter snow pack, areas at risk may be inundated nearly every year.

Conditions which may exacerbate floods:

- Impermeable surfaces
- Steeply sloped watersheds
- Constrictions
- Obstructions
- Debris
- Contamination
- Soil saturation
- Velocity

Explanation of Common Flood Terms

FIRM: Flood Insurance Rate Map



100-year flood: Applies to an area that has a 1 percent chance, on average, of flooding in any given year. However, a 100-year flood could occur two years in a row, or once every 10 years. The 100 year-flood is also referred to as the base flood.

Base Flood: Is the standard that has been adopted for the NFIP. It is a national standard that represents a compromise between minor floods and the greatest flood likely to occur in a given area and provides a useful benchmark.

Base Flood Elevation (BFE): As shown on the FIRM, is the elevation of the water surface resulting from a flood that has a 1% chance of occurring in any given year. The BFE is the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum (NGVD) or 1929, the North American Vertical Datum (NAVD) of 1988, or other datum referenced in the FIS report.

National Flood Insurance Program (NFIP): The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the VFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

Special Flood Hazard Area (SFHA): Is the shaded area on a FIRM that identifies an area that has a 1% chance of being flooded in any given year (100-year floodplain).

Floodway: Is the stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising that water surface elevation by more than one foot.

Dam Failure

Dam failures result from the failure of a man made water impoundment structure, which often results in catastrophic down grade flooding. Dam failures are caused by one or a combination of the following: "breach from flooding or overtopping, ground shaking from earthquakes, settlement from liquefaction, slope failure, internal erosion from piping, failure of foundations and abutments, outlet leaks or failures, vegetation and rodents, poor construction, lack of maintenance and repair, misuse, improper operation, terrorism, or a combination of any of these" (Eldredge 46). The Utah State Engineer has been charged with regulating non-federal dams in the State since 1919. "In the late 1970's Utah started its own Dam Safety Section within the State of Utah Engineers Office to administer all non-federal dams in response to the Federal Dam Safety Act (PL-92-367)" (Eldredge 46).

The State Dam Safety Section has developed a hazard rating system for all non-federal dams in Utah. Downstream uses, the size, height, volume, and incremental risk/damage assessments of dams are all variables used to assign dam hazard ratings in the Dam Safety classification system. Using the hazard ratings systems developed by the Dam Safety Section, dams are placed into one of three classifications high, moderate, and low. Dams receiving a low rating would have insignificant property loss do to dam failure. Moderate hazard dams would cause significant property loss in the event of a breach. High hazard dams would cause a possible loss of life in the event of a rupture. The frequency of dam inspection is designated based on hazard rating with the Division of Water Rights inspecting high-hazard dams annually, moderate hazard dams biannually, and low-hazard dams every five years. There are 151 dams within the Mountainland Region of those 43 have received a high hazard rating by Dam Safety.

The following information regarding a failure of both Jordenelle and Deer Creek Dams and resulting loss was prepared by the United States Department of the Interior Bureau of Reclamation entitled "Dam Failure and Maximum Operational Release, Inundation Study: Deer Creek Dam" completed, February 2002.

Introduction and Purpose

On February 27, 1995, the Commissioner of the Bureau of Reclamation (Reclamation) issued a policy statement regarding establishing an Emergency Management Program at Reclamation dams. This policy stated that Reclamation would offer technical support and assistance to communities and jurisdictions downstream of Reclamation dams to ensure that adequate dam-specific emergency operation plans are in place. Directives for the emergency management program state that Emergency Actions Plans (EAP) shall be developed and are to contain descriptions of potentially affected areas in the flood plain with inundation maps wherever appropriate. This dam failure study was prepared to meet the goals and objectives of the Commissioner's directives.

The purpose of this study is to identify potential flood hazard areas resulting from the unlikely events of "sunny day" failure of Deer Creek Dam, the maximum operational release of Deer Creek Dam and the "sunny day" failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping.

These studies are standard practice within Reclamation and therefore do not reflect in any way upon the integrity of either Jordanelle or Deer Creek Dams.

Previous Studies

The Denver Office completed a previous Flood Inundation Study in June of 1990. It addressed two conditions, 1) a PMF (Probable Maximum Flood) causing the failure of Deer Creek Dam; and 2) a PMF (Probable Maximum Flood) causing the failure of Jordanelle Dam, which then results in the failure of Deer Creek Dam. Both scenarios were accomplished using the National Weather Service (NWS) DAMBRK model. Cross sections, and some dam breach parameters were obtained from these studies for use in this report.

Description of Jordanelle Dam

Jordanelle Dam and reservoir is located on the Provo River in Wasatch County in north central Utah about 5 miles north of Heber City, Utah. Jordanelle Dam is a rolled earthfill structure with a fuse plug emergency spillway and outlet works. The reservoir has a storage capacity of 311,000 acre-feet at active conservation, which is elevation 6,166.4 feet. The total reservoir storage capacity is 361,500 acre-feet at elevation 6,182.0.

The rolled earth embankment section of Jordanelle Dam has a structural height of 300 feet and a crest length of 3820 feet at elevation 6185.0 feet.

The emergency fuse plug spillway is located near the left abutment and consists of an unlined inlet channel, a concrete lined trapezoidal channel, an earthen plug section, a concrete chute, and a 9.5-foot by 10-foot concrete double box conduit. The design flow of the spillway is 5,510 cfs at elevation 6182.0 feet.

The outlet works is located within the left abutment and consists of two primary outlet works intake structures one (LLOW) Low level outlet works and one (SLOW) selective level outlet works merging into a common outlet pipe and a bypass system. The capacities for the outlet works are 3,269 cfs and 2,153 cfs respectively at elevation 6,086.7. The bypass system taps into both the SLOW and LLOW upstream of the emergency gates with a capacity of 300 cfs at elevation 6,166.0 feet.

The primary purpose of the reservoir is to provide M&I water for use in Salt Lake City and northern Utah County. Additional project purposes include flood control, recreation, Heber Valley irrigation water, and fish and wildlife enhancement.

Description of Deer Creek Dam

Deer Creek Dam and reservoir are located on the Provo River about 16 miles northeast of Provo, Utah and about 10 miles southwest of Heber City, Utah. Deer Creek Dam consists of a zoned earthfill structure, spillway and outlet works. The reservoir has a storage capacity of 152,570 acre-feet at the top of the gates, which is elevation 5,417 feet.

Deer Creek Dam has a structural height of 235 feet and a crest length of 1,304 feet at elevation 5,425 feet. There is a parapet wall, which extends 3.5 feet above the crest to elevation 5,428.5 feet.

The concrete chute spillway, located on the right abutment of the dam, is controlled by two 21- by 20-foot high radial gates. The spillway crest elevation is 5,397.0 feet and has a capacity of 12,000 cfs at elevation 5,420.1 feet.

The outlet works, located in the left abutment of the dam consists of: a drop type trashrack structure, a 12-foot-diameter circular tunnel, a gate chamber with two 5-foot by 6-foot high-pressure emergency gates side by side, an 11-foot 6-inch by 17-foot access tunnel which holds two 72-inch-diameter steel penstocks that carry water into the powerplant. The capacity of the outlet works is 1,500 cfs at elevation 5,420 feet.

Deer Creek Reservoir is part of a collection system, which stores and releases water from the Duchesne River, Weber River, and also the Provo River drainage. The primary recipients of the water are cities and farms along the Wasatch Front. It also provides year-round power generation and is used heavily for recreational purposes.

Method of Analysis

The primary purpose of the inundation maps is for warning and evacuation in the event of a dam failure or a large reservoir release. Values chosen to approximate physical characteristics such as dam failure breach parameters, channel roughness coefficients, etc., are based on assumptions and are used to produce best estimates of the downstream inundation. Thus, actual inundation were it to occur, could be greater or less than that indicated on the inundation maps.

For this study, the results of the one dimensional National Weather Service (NWS) DAMBRK model performed by the Denver Office was used to obtain the dam break flows from both Jordanelle Dam to Deer Creek Dam and from Deer Creek Dam to the mouth of Provo Canyon. However, the terrain beyond the mouth of Provo canyon is an alluvial fan, which unlike the narrow confined canyon, is a broad, flat plain. A two dimensional model is more appropriate for this type of terrain. It provides a more accurate depiction of the topography and allows for the water to spread and follow multiple drainage paths. The modeling tools used for the Orem/Provo areas utilized the Danish Hydraulic Institute's MIKE 21 two-dimensional hydrodynamic flow model. MIKE 21 is a 2-D finite difference model that simulates unsteady 2-D flows in (vertically homogeneous) fluids using the Saint Venant equations. ARCINFO GIS software is used as both a pre and post processor for the MIKE 21 model. Data used for the Deer Creek Dam models came from 7.5 minute, 10-meter resolution, digital elevation models (DEM) prepared by Land Info Inc., of Aurora, Colorado. The 10-meter data was then resampled at 30-meter cell size for use in the MIKE 21 models. The 10-meter elevation data appeared to be satisfactory for this study however for a more detailed study of the metropolitan area a better resolution of elevation data is recommended.

Study Details

Sunny Day Failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping.

The model using the National Weather Service DAMBRK program, with BOSS Corporation software enhancements, was used in the routing from Jordanelle Dam thru Deer Creek Reservoir and then to the mouth of the Provo canyon. The MIKE 21 two-dimensional (2-D) computer model was used in routing the releases from the mouth Provo canyon to Utah Lake.

Cross sections of the downstream areas of both Jordanelle and Deer Creek Dams that were used in the DAMBRK model were obtained from the 1990 study performed by the Denver Office.

The storage capacity for Jordanelle Reservoir was taken from the 1993 area capacity tables. Jordanelle reservoir water surface is assumed to be at active conservation, elevation 6166.4 feet, at the beginning of the piping failure simulation. The failure of Jordanelle Dam was assumed to develop in 2.0 hours, with piping beginning at elevation 6,000 feet. A bottom breach width of 500 feet was assumed, with side slopes of 1: 0.50, which resulted in a peak flow of 3,542,000 cfs.

Table 4.5 indicates the sensitivity of breach parameters by varying the time of dam breach formation and leaving the other parameters the same. The 2-hour breach time was assumed conservative considering the design and construction criteria of the dam.

Table 4.5 Breach Parameters of Jordanelle Dam

Time of Breach Formation (hours)	Bottom Breach Width (feet)	Breach Side Slopes	Maximum Flow at Jordanelle Dam (CFS)
1.0	500	1: 0.50	5,020,000
*2.0	500	1: 0.50	3,542,000
3.0	500	1: 0.50	2,806,000

The storage capacity for Deer Creek Reservoir was taken from the 1962 area capacity tables. Deer Creek reservoir water surface is assumed to be at top of conservation, elevation 5417 feet at the beginning of Jordanelle Dam Failure. Deer Creek Dam is assumed to fail when the water surface reaches 1 foot over the top of the parapet wall at elevation 5428.5 feet. The breach develops in 1 hour and achieves a bottom breach width of 300 feet. A DAMBRK hydrograph, was taken at the mouth of Provo Canyon at river mile 10.0, and used as input data for the MIKE 21 model. The MIKE 21 input parameters used in this routing are listed in Table 4.6.

Table 4.6 MIKE 21 input parameters

Flooding parameter*	0.15 meters
Drying parameter*	0.1 meters
Time step interval	1 second
Mannings "n" value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Sunny Day Failure of Deer Creek Dam due to piping

The model using the National Weather Service DAMBRK program, with BOSS Corporation software enhancements were used in the routing to the mouth of Provo canyon. The MIKE 21 two-dimensional (2-D) computer model was used in routing the releases from the mouth Provo canyon to Utah Lake. Cross sections of the downstream areas of both Jordanelle and Deer Creek Dams used in the DAMBRK model were obtained from the 1990 study performed by the Denver Office.

Deer Creek reservoir water surface is assumed to be at top of conservation, elevation 5417 feet at the beginning of the piping failure. The breach is assumed to develop in 1 hour and achieve a bottom breach width of 500 feet, which resulted in a peak flow of 1,550,000 cfs. Table 4.7 indicates the sensitivity of breach parameters by varying the time of dam breach formation and leaving the other parameters the same. The 1-hour breach time was assumed conservative considering the design and construction criteria of the dam.

Table 4.7 Breach Parameters of Deer Creek Dam

Time of Breach Formation (hours)	Bottom Breach Width (feet)	Breach Side Slopes	Maximum Flow at Deer Creek Dam (CFS)
0.5	500	1: 0.50	1,826,000
1.0	500	1: 0.50	1,550,000
2.0	500	1: 0.50	1,275,000

A DAMBRK hydrograph, was taken at the mouth of Provo Canyon at river mile 10.0, and used as input data for the MIKE 21 model. The MIKE 21 input parameters used in this routing are listed in Table 4.8.

Table 4.8 MIKE 21 input parameters

Flooding parameter*	0.3 meters
Drying parameter*	0.2 meters
Time step interval	1 second
Mannings "n" value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Deer Creek Dam Maximum Operational Release

The maximum operational release from Deer Creek Dam was modeled using a constant outflow of 13,500 cfs. The 13,500 cfs release was based on the maximum release from the dam and was used to indicate maximum water depths at each cross section using a constant flow. This was considered a conservative estimate based on the assumption that the flow would not generally maintain this volume at each cross section, but instead would decrease in depth as the reservoir emptied. The same constant flow of 13,500 cfs was used as input data for the MIKE 21 model, which begins at the mouth of Provo Canyon. MIKE 21 input parameters are listed in Table 4.9.

Table 4.9 MIKE 21 input parameters

Flooding parameter*	0.3 meters
Drying parameter*	0.2 meters
Time step interval	1 second
Mannings “n” value	0.04

* The flooding parameter sets the minimum water depth required in a given cell in order for water to begin flowing into adjacent model cells. Conversely, the drying parameter sets a depth requirement below which the cell begins to dry out.

Downstream routing and description

The study begins at Jordanelle Dam located on the Provo River about 5 miles north of Heber City, Utah, and extends through Deer Creek Reservoir and Dam to Utah Lake near Provo, Utah. Seven cross sections from the study performed in 1991 were used to identify the area below Jordanelle Dam. The cross sections extended along the Provo River approximately 9.0 river miles to Deer Creek Reservoir. Six cross sections from the study performed in 1991 were used to identify the area below Deer Creek Dam. The cross sections extended along the Provo River approximately 10 river miles to the mouth of Provo Canyon. The cross sections were obtained using U.S. Geological Survey Quadrangle maps (Scale 1:24000) consisting of 40-foot contours. The Manning's n value used to represent the roughness coefficient of the downstream channel to the mouth of the canyon was 0.04. Some minor adjustments were made to some of the cross sections in order to obtain numerical stability in the DAMBRK model. Beyond the mouth of the canyon, it flows through some of Orem and Provo, Utah and then into Utah Lake.

Study Results

The results indicate that flooding resulting from the sunny day failures of either Jordanelle or Deer Creek Dams will inundate the residential areas along the Provo Canyon corridor and in Orem and Provo, which could result in the loss of life. In addition, parts of Springville located within the flood plain south of Provo, Utah as well as major highways and road crossings would be heavily impacted by the floodwaters.

The routings of the floods were terminated at approximately 10 hours for the sunny day failure of Jordanelle and Deer Creek Dams. About 10 hours after flooding begins, most of the floodwaters are safely contained by Utah Lake. The results of the flood routing are listed in the attached tables.

Table 4.9A Sunny day failure of Jordanelle Dam resulting in the failure of Deer Creek Dam due to overtopping, identifies results obtained from the sunny day failure of Jordanelle Dam modeled as a piping failure. The table includes the maximum water surface, peak flows, and flood arrival times from the beginning of the failure of Jordanelle Dam to the flood arrival at the mouth of Provo Canyon.

Table 4.9A Sunny day failure of Jordanelle Dam

River Miles Downstream of Deer Creek Dam	Maximum Water Surface Elev (Feet)	Depth Above Streambed (Feet)	Arrival Time of Leading Edge (Hrs)	Arrival Time of Peak Flow (Hrs)	Maximum Flow (CFS)	Location
0.0	5439	165	River Miles Downstream of Deer Creek Dam	2.5	3,573,000	Deer Creek Dam
10.0	4926	104	2.0	2.9	3,124,000	Mouth of Provo Canyon

*****Arrival times are from the beginning of Jordanelle Dam failure
*****Mile 0.0 is at the downstream toe of Deer Creek Dam

Table 4.9B. Sunny day failure of Jordanelle Dam resulting in the failure of Deer Creek Dam identifies results obtained from the sunny day failure of Jordanelle Dam. The table covers the area from the mouth of Provo Canyon to Utah Lake. Maximum discharge and times, at Provo City, were extracted from the MIKE21 model output file for use in the table.

Table 4.9B. Sunny day failure of Jordanelle Dam

River Miles Downstream of Deer Creek Dam	Estimated Time to Leading Edge (Hrs)	Time to Maximum Discharge (Hrs)	Calculated Maximum Discharge (CFS)	Location
14.5	2.5	3.0	3,085,000	Provo City

*Times to discharges are from the beginning of Jordanelle Dam failure

Table 4.10A Sunny day failure of failure of Deer Creek Dam identifies results obtained from the sunny day failure of Deer Creek Dam modeled as a piping failure. The table includes the maximum water surface, peak flows, and flood arrival times from the beginning of the failure of Deer Creek Dam to the flood arrival at the mouth of Provo Canyon.

Table 4.10A . Sunny day failure of Deer Creek Dam

River Miles Downstream of Deer Creek Dam	Maximum Water Surface Elev (Feet)	Depth Above Streambed (Feet)	Arrival Time of Leading Edge (Hrs)	Arrival Time of Peak Flow (Hrs)	Maximum Flow (CFS)	Location
0.0	5381	107	0.1	0.7	1,550,000	Deer Creek Dam
10.0	4915	93	0.8	1.1	1,397,000	Mouth of Provo Canyon

*****Arrival times are from the beginning of Deer Creek Dam failure
*****Mile 0.0 is at the downstream toe of Deer Creek Dam

Table 4.10B. Sunny day failure of Deer Creek Dam, identifies results obtained from the sunny day failure of Deer Creek Dam. The table covers the area from the mouth of Provo Canyon to Utah Lake. Maximum discharge and times, at Provo City, were extracted from the MIKE21 model output file for use in the table.

Table 4.10B. Sunny day failure of Deer Creek Dam

River Miles Downstream of Deer Creek Dam	Estimated Time to Leading Edge (Hrs)	Time to Maximum Discharge (Hrs)	Calculated Maximum Discharge (CFS)	Location
14.5	0.9	1.2	1,386,000	Provo City

*Times to Maximum discharge are from the beginning of Deer Creek Dam failure

Table 4.11. Maximum operational release of Deer Creek Dam identifies the results of the maximum operational release from Deer Creek Dam to the mouth of Provo Canyon, based on the maximum release of 13,500 cfs. The table includes the maximum water surface, depth above streambed, and peak flows obtained at the cross sections modeled.

Table 4.11. Maximum operational releases of Deer Creek Dam (Releases are based on continuous flow of 13,500 cfs)

River Miles Downstream of Deer Creek Dam	Maximum Water Surface (Elev)	Depth Above Streambed (Feet)	Maximum Flow (CFS)
0.0	5289	15	13,500
10.0	4836	14	13,500

*****Mile 0.0 is at the downstream toe of Deer Creek Dam

Inundation Maps

Inundation maps produced from this study are shown on U.S. Geological Survey Quadrangle maps (Scale 1:24,000). They combine flood inundation boundaries from both the National Weather Service's (NWS) DAMBRK one dimensional model, which was used to route flows between Deer Creek Dam and the mouth of Provo Canyon, and MIKE 21, the two dimensional model which terminates at Utah Lake. The flood inundation boundaries shown on the maps for each scenario were taken from the 1993 study and are depicted in red from the dam to the mouth of Provo Canyon. The flood boundaries from the mouth of Provo Canyon to Utah Lake are color coded according to water depth. The water depths shown on the map represent an estimate of the maximum water depth that could occur at various locations within the inundated area. Also shown are colored lines that indicate the progression of the leading edge of the flooding at various time intervals. These time-sequenced flood-progression lines do not correlate directly to the water depths of the maximum inundation boundary. The inundation boundary for the 1-D operational release from Deer Creek Dam to the mouth of Provo canyon was not included on the maps due to the coarse topography indicated on the 1:24000 scale quadrangles.

The maps are located in the county annexes.

Wildland Fire

Identifying Hazards

A wildfire is an uncontrolled fire spreading through vegetative fuel often exposing or consuming structures. Wildfires often begin unnoticed and spread quickly and are usually sighted by dense smoke. Wildfires are placed into two classifications Wildland and Urban-Wildland Interface. Wildland fires are those occurring in an area where development is essentially nonexistent, except for roads, railroads, or power lines. Urban-Wildland Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. URWIN areas are divided into three subclasses, each evident in counties within Mountainland:

Occluded

Occluded interface, are areas of wildlands within an urban area for example a park bordered by urban development such as homes.

Intermixed

Mixed or intermixed interface areas contain structures scattered throughout rural areas covered predominately by native flammable vegetation.

Classic

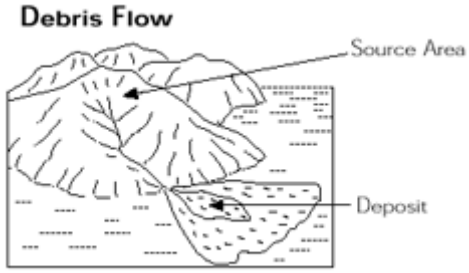
Classic interface areas are those areas where homes press against wildland vegetation along a broad front.

When discussing wildfires it is important to remember that fires are part of a natural process and are needed to maintain a healthy ecosystem. Three basic elements are needed for a fire to occur (1) a heat source (2) oxygen and (3) fuel. Two of the three sources are readily available in the counties making up the Mountainland region. Major ignition sources for wildfire are lightning and human causes such as arson, prescribed burns, recreational activities, burning debris, and carelessness with fireworks. On average, 65 percent of all wild fires started in Utah can be attributed to human activities. Once a wildfire has started, vegetation, topography and weather are all conditions having an affect wildfire behavior.

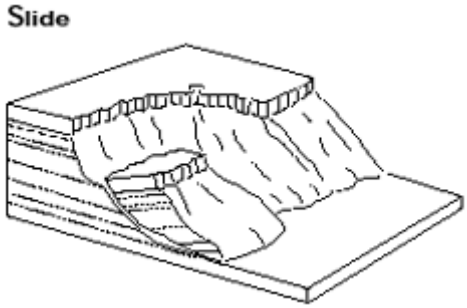
Landslides

Landslides are a “down slope movement of a mass of rock, earth, or debris”. Landslides, often referred to as mass wasting or slope failures, are one of the most common natural disasters (Cruden 36). Slope failures can vary considerably in shape, rate of movement, extent, and effect on surrounding areas. Slope failures are classified by their type of movement, and type of material. The types of movement are classified as falls, slides, topples, and flows. “The types of material include rock, debris (coarse grained soil) and earth (fine grained soil)” (Eldredge 17). “Types of slope failures then are identified as rock falls, rock slides, debris flows, debris slides, and so on” (Eldredge 17). Slope failures occur because of either an increases in the driving forces (weight of slope and slope gradient) or a decrease in the resisting forces (friction, or the strength of the material making up a slope). “Geology (rock type and structure), topography (slope gradient), water content, vegetative cover, and slope aspect are important factors of slope stability” (Eldredge 18).

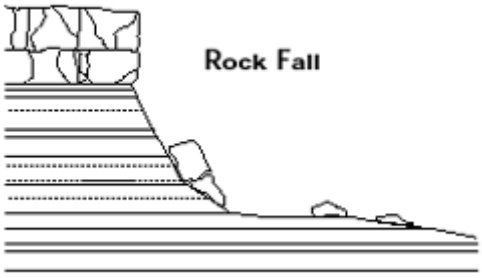
Three Common Types of Landslides in Utah



Debris flows consist of sediment-water mixtures that flow down a streambed or hillside, commonly depositing sediment at canyon mouths in fan like deposits know as alluvial fans.



Slides are down slope movements of soil or rock on slopes.



Rock falls consist of rock(s) falling from a cliff or cut slope and are very common in the canyon country of southern Utah.

Conditions That Make Slopes More Susceptible to Landslides

- Discontinuities: faults, joints, bedding surfaces.
- Massive Materials over soft materials.
- Orientations of dip slope: bedding plans that dip out of slope.
- Loose structure and roundness.
- Adding weight to the head of a slide area: rain, snow, landslides, mine waste piles, buildings, leaks from pipes, sewers, and canals, construction materials fill materials.
- Ground shaking: earthquakes or vibrations.
- Increase in lateral spread caused by mechanical weathering.
- Removal of lateral support.
- Human activities: cut and fill practices, quarries, mine pits, road cuts, lowering of reservoirs.
- Removing underlying support: under cutting of banks in a river.
- Increase in pore water pressure: snow melt, rain, and irrigation.
- Loss of cohesion.

Problem Soils

Problem soils and rock constitute a widespread geologic hazard in Utah, covering approximately 18 to 20 percent of the state, and underlie many urbanized areas. The nine types of problem soil and rock in Utah are:

- Expansive Soil
- Collapsible Soil
- Limestone and Karst Terrain
- Gypsiferous Soil
- Soil Subject to Piping
- Dunes
- Peat
- Mine Subsidence
- Sodium Sulfate

Problems soils affecting the Mountainland region include expansive and collapsible soils and Mine Subsidence.

Expansive Soil and Rock

Clay minerals found in soils and rock expand and contract due to changes in moisture content. The most common clay mineral associated with expansive soils in Utah is montmorillonite, "which expands up to 2,000 times its original size, and can exert pressures up to 11,000 pounds per square foot" (Eldredge 30). The cracks created by the expansion and contraction process create a positive feed back mechanism that allows more water to enter during the next storm cycle. Within the Mountainland Region expansive soils are found along the eastern foothills and within Utah County. Problems associated with expansive materials are cracked foundations, heaving and cracking of road surfaces, failure of wastewater disposal systems, and broken water lines.

Collapsible Soil

Collapsible soil causes ground-surface subsidence when loose, dry, low density deposits decrease in volume when saturated for the first time since deposition. Frequently the water introduced into these soils is from human sources such as irrigation, water impoundment, lawn watering, alterations to natural drainages, and/or wastewater disposal.

Mine Subsidence{tc "Mine Subsidence"}

Utah has a long history of mining and there are numerous mines within Utah. Mining removes rock and leaves voids that, if not supported, can collapse and cause subsidence of the ground surface and sinkholes. Subsidence can occur in both active and abandoned mines.

Earthquakes

An earthquake is the abrupt shaking of the earth caused by the sudden breaking of rocks when they can no longer withstand the stresses, which build up deep beneath the earth's surface. The rocks tend to rupture along weak zones referred to as faults. When rocks break they produce seismic waves that are transmitted through the rock outward producing ground shaking. Earthquakes are unique multi-hazard events, with the potential to cause huge amounts of damage and loss. Secondary effects of a sudden release of seismic energy (earthquake) include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, slope failure, and various types of flooding.

The Intermountain Seismic Belt

The Intermountain Seismic Belt (ISB), which Mountainland is part of, is a zone of pronounced earthquake activity up to 120 miles wide extending in a north south direction 800 miles from Montana to northern Arizona. The Utah portion of the ISB trends from the Tremonton Cache Valley area south through the center of the state, along the Wasatch Front, and the southwest through Richfield and Cedar City concluding in St. George. "The zone generally coincides with the boundary between the Basin and Range physiographic province to the west and the Middle Rocky Mountains and Colorado Plateau physiographic provinces to the east" (Eldredge 6).

Secondary Earthquake Threats

The major secondary effects of earthquakes include: ground shaking, surface fault rupture, liquefaction, tectonic subsidence, avalanches, rock fall, slope failure, and various types of flooding. Other sections discuss landslides, and flooding therefore they will not be discussed under secondary effects of earthquakes yet importance needs to be given to the fact that earthquakes can increase the likelihood of flooding and landslides.

Ground Shaking

Ground shaking causes the most impact during an earthquake because it affects large areas and is the origin of many secondary effects associated with earthquakes. Ground shaking, which generally lasts 10 to 30 seconds in large earthquakes, is caused by the passage of seismic waves generated by earthquakes. Earthquake waves vary in both frequency and amplitude. High frequency low amplitude waves cause more damage to short stiff structures, were as low frequency high amplitude waves have a greater effect on tall (high-rise) structures. Ground shaking is measured using Peak Ground Acceleration (PGA). The PGA measures the rate in change of motion relative to the established rate of acceleration due to gravity.

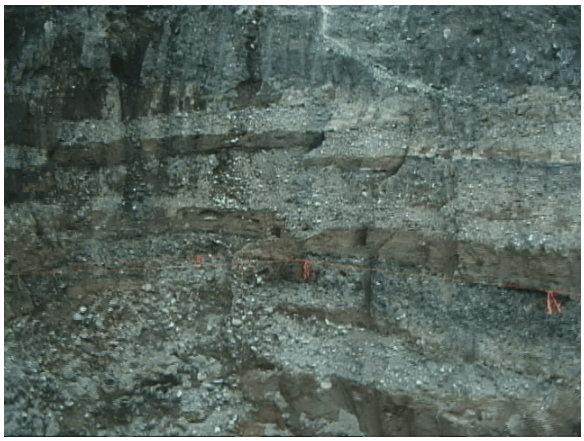
Local geologic conditions such as depth of sediment and sediment make up, affect earthquake waves. Deep valley sediments increase the frequency of seismic waves relative to bedrock. In general, ground shaking increases with increased thickness of sediments" (Eldredge 8). Findings in recent geologic research done by Ivan Wong indicate and earthquake in Salt Lake County would produce higher PGA values than previously expected near faults and areas of near surface bedrock.

Surface Fault Rupture

During a large earthquake fault movement may propagate along a fault plain to the surface, resulting in surface rupture along the fault plain. The Wasatch fault is a normal (mountain building) fault with regards to movement, meaning the footwall of the fault moves upward and the hanging wall moves in a down direction. Thus faulting is on a vertical plain, which results in the formation of large fault scarps. Surface fault rupture along the Wasatch fault is expected for earthquakes with magnitudes of 6.5 or larger. The largest probable earthquake that could strike the Mountainland region is an earthquake with an estimated magnitude between 7.0 and 7.5; an earthquake of this magnitude, based on current research,

would create "surface fault rupture with a displacement of between 16 to 20 feet in height with break segments 12 to 44 miles long" (Eldredge 10). In historic time surface fault rupture has only occurred once in Utah; the 1934 Hansel Valley earthquake with a magnitude 6.6 produced 1.6 feet of vertical offset.

Surface fault rupture presents several hazards, anything built on top of the fault or crossing the fault has a high potential to be destroyed in the event of displacement. Foundations will be cracked, building torn apart, damage to roads, utility lines, pipelines, or any other utility line crossing the fault. It is almost impossible to design anything within reasonable cost parameters to withstand an estimated displacement of 16 to 20 feet.



Picture 4.1 Displacement in excavation near Downtown Salt Lake.

Severe Weather

For the purpose of this mitigation plan the term "severe weather" is used to represent downbursts, lightening, heavy snowstorms, blizzards, avalanches, hail, and tornados.

Downbursts

A downburst is a severe localized wind, blasting from a thunderstorm. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories by size: microbursts, which cover an area less than 2.5 miles in diameter, and macrobursts, which cover an area with a diameter larger 2.5 miles.

Lightening

During the development of a thunderstorm, the rapidly rising air within the cloud, combined with the movement of the precipitation within the cloud, causes electrical charges to build. Generally, positive charges build up near the top of the cloud, while negative charges build up near the bottom. Normally, the earth's surface has a slight negative charge. However, as the negative charges build up near the base of the cloud, the ground beneath the cloud and the area surrounding the cloud becomes positively charged. As the cloud moves, these induced positive charges on the ground follow the cloud like a shadow. Lightening is a giant spark of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges. When the potential between the positive and negative charges becomes to great, there is a discharge of electricity that we know as lightning.

Heavy Snowstorms

A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period. According to the official definition given by the U.S. Weather Service, the winds must exceed 35 miles per hour and the temperature must drop to twenty degrees Fahrenheit 20^{o} F or lower. All winter storms make driving extremely dangerous.

Blizzards

A blizzard is a snowstorm with sustained winds of 40 miles per hour (mph) or more or gusting winds up to at least 50 mph with heavy falling or blowing snow, persisting for one hour or more, temperatures of ten degrees Fahrenheit (10^{o} F) or colder and potentially life-threatening travel conditions. The definition includes the conditions under which dry snow, which has previously fallen, is whipped into the air and creates a diminution of visual range.

Avalanches

Avalanches are a rapid down-slope movement of snow, ice, and debris. Snow avalanches are a significant mountain hazard in Utah, and nationally account for more deaths each year than earthquakes. Avalanches are the result of snow accumulation on a step slope and can be triggered by ground shaking, sound, or a person. Avalanches consist of a starting zone, a track, and a run-out zone. The starting zone is where the ice or snow breaks loose and starts to slide. The Track is the grade or channel down which an avalanche travels. The run-out zone is where an avalanche stops and deposits the snow.

The two main factors affecting avalanche activity include weather and terrain, large frequent storms combined with steep slopes result in avalanche danger. Additional factors that contributing to slope stability are amount of snow, rate of accumulation, moisture content, snow crystal types and the wind speed and direction. In Utah, the months of January through April have the highest avalanche risk.

Topography plays a vital role avalanche dynamics. Slope angles between 30 to 45 degrees are optimum for avalanches with 38 degrees being the bulls-eye. Slopes with an angle above 45 degrees continually slough eliminating large accumulation. The risk of avalanches decreases on slope angles below 30 degrees.

Types of Avalanches Common in Utah:

Dry or slab avalanches occur when a cohesive slab of snow fractures as a unit and slides on top of weaker snow, breaking apart as it slides. Slab avalanches occur when additional weight is added quickly to the snow pack, overloading a buried weaker layer. Dry snow avalanches usually travel between 60-80 miles per hour, reaching this speed within 5 seconds of the fracture, resulting in the deadliest form of snow avalanche.

Wet avalanches: occur when percolating water dissolves the bonds between the snow grains in a pre-existing snow pack, this decrease the strength of the buried weak layer. Strong sun or warm temperatures can melt the snow and create wet avalanches. Wet avalanches usually travel about 20 miles per hour.

Hail Storms

Hailstones are large pieces of ice that fall from powerful thunderstorms. Hail forms when strong updrafts within the convection cell of a cumulonimbus cloud carry water droplets upward causing them to freeze. Once the droplet freezes, it collides with other liquid droplets that freeze on contact. These rise and fall cycles continue until the hailstone becomes too heavy and falls from the cloud.

Tornados

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. Tornados often occur at the edge of an updraft or within the air coming down from a thunderstorm. Tornadoes can have wind speeds of 250 miles per hour or more, causing a damage zone of 50 miles in length and 1 mile wide. Most tornados have winds less than 112 miles per hour and zones of damage less than 100 feet wide.

Waterspout

Waterspouts are simply tornadoes that form over warm water. This typically occurs in Utah during a cold fall or late winter storm.

Scale

Tornadoes are classified by wind damage using the Fujita Scale. The National Weather Service has used the Fujita Scale since 1973. This scale uses numbers from 0 through 5 with higher numbers assigned based on the amount and type of wind damage.

Table 4.12 Fujita Scale

Category F0	Gale tornado (40-72 mph)	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
Category F1	Moderate tornado (73-112 mph)	Moderate damage. The lowers limit is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
Category F2	Significant tornado (113-157 mph)	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
Category F3	Severe tornado (158-206 mph)	Severe damage. Roofs and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
Category F4	Devastating tornado (207-260 mph)	Devastating damage. Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.
Category F5	Incredible tornado (261-318 mph)	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobiles-size missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur.

Drought

Drought is a normal recurrent feature of climate, although many people in Utah erroneously consider it a rare and random event. It occurs in virtually all-climatic zones, while its characteristics vary significantly from one region to another. Droughts, simply put, are cumulative hazards, which result from long periods of below normal precipitation. Drought is a temporary aberration and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate.

The State or Utah, uses the Palmer Drought Severity Index or (PDSI) to quantify the existence of a drought. Using the PDSI, drought is expressed as a negative number. Much of the basis, used by the State, to determine drought years, or drought periods, comes from the PDSI. In addition, the State Climatologist, the National Geophysical Data Center of NOAA, and the National Drought Mitigation Center use the PDSI. Further information on the Palmer Drought Severity Index can be found in Appendix F.

For the most part droughts no longer affect the availability of drinking water, thus they no longer place peoples lives at risk, the same cannot be said for a person's livelihood. Numerous water projects throughout the state have placed enough water in storage to insure drinking water. Prolonged droughts have a significant affect on agricultural and agribusinesses, within the states dependent on irrigation water. Droughts also stress wildlife, and heighten the risk of wildfire.

Infestation

Infestation normally deals with insect infestations; however; infestations may also include rodent or other animal invasion. To infest means to spread or swarm over in a troublesome manner. The Mountainland Region has had two recent infestations. The most devastating invasion, in relation to cost, has been the Mormon Cricket. In June of 2003, Utah Governor Mike Leavitt declared a State of Emergency in 18 of Utah's 29 counties, where crickets and grasshoppers had eaten 1.5 million acres. Problems associated with cricket infestations usually deal with crop loss as well as loss of rangeland for cattle and sheep. Consumption of residential landscaping is also a problem and more homes are built in western Utah County in which is in the path of crickets. The crickets usually travel from west to east, starting in Nevada. In some instances the cricket mass is so large and dense that cars and trucks lose traction on roads. Vehicles sliding off of roads can cause property damage and personal injury.

The Mormon cricket has reached legendary status in the State of Utah. This devastating insect plagued the early pioneers. Today, 150 years later, the Mormon cricket still economically devastates some parts of Utah.

Economic Damage

The Mormon cricket is not a true cricket. The insect resembles more a lifestyle of a grasshopper. Mormon crickets are of economic importance in the fact that they destroy plants on rangeland, cropland, and vegetable gardens. Male and female Mormon crickets are large insects and can reach lengths of two and one-half inches during the adult stage. The female Mormon cricket is distinguished by the long ovipositor that also looks like a type of "stinger" located at the end of the abdomen. The male lacks this ovipositor. The Mormon cricket can be economically devastating. It has been calculated that a Mormon cricket at a density of one per square yard can consume 38 pounds of dry weight rangeland forage per acre. In Utah, the Mormon cricket destroys sagebrush, alfalfa, small grains, seeds, grasses, and vegetable crops.

Life Cycle and Characteristics

Mormon crickets hatch during the spring, and depending on elevation usually around the first few weeks of April. Young Mormon crickets are called nymphs. These nymphs develop during the spring months. They undergo seven stages of development called in-stars. It takes 60 to 90 days for the Mormon cricket to pass through these seven stages and obtain the adult stage. The female Mormon cricket lays its eggs during the summer months. The incubation of the eggs occurs during the fall and winter months. The eggs start hatching when soil temperatures reach 40 degrees Fahrenheit. The Mormon cricket cannot fly, but is still an extremely mobile insect. When the crickets are young, they do not migrate long distances. After about the fourth in-star and during the adult stage the Mormon crickets become ravenous and start banding together. Once the crickets have banded together, they begin migrating. During their migrations they destroy everything in their path. Mormon crickets are usually found migrating when skies are clear and temperatures are around 60 to 90 degrees Fahrenheit. In Utah, the crickets migrate under favorable conditions around 10:00 a.m. until about 2:00 p.m. Mormon crickets in the adult stage can cover a mile a

day and up to 50 miles in a single season. During the night and during cold, wet weather, Mormon crickets clump together and can be seen clinging together on grasses and brush. They will also burrow underneath grass and brush to keep warm. The Mormon cricket is a hearty insect. They have been seen feeding when temperatures were less than 35 degrees Fahrenheit.

Control Methods

The most effective way to reduce Mormon cricket populations is to use carbaryl bait. The trade name is Sevin bait. This is usually oatmeal coated with the chemical insecticide carbaryl. The recommended application rate is 10 pounds to the acre. Using hand-held fertilizer spreaders can spread the bait or large machines that blow the poisoned grain a long distance. The idea is to apply a barrier of bait around or in front of a band of migrating crickets. Once the first wave consumes the bait they will die within a few minutes. The crickets coming from behind will eat the dead crickets causing a chain reaction of crickets being killed by the bait. Mormon crickets do not fly so they will almost always hit the barrier of poisoned bait. Many ranchers and farmers will apply the bait around the perimeter of their fields to reduce the number of crickets invading. Bait is also applied along roadsides to reduce the risk of car accidents from large numbers of crickets crossing highways. It is best to apply the bait when the crickets are still young or in the developing stages. Insecticide sprays such as Malathion could be effective against the Mormon cricket if they were sprayed during the nymphal stage. These insecticide sprays usually aren't recommended. Sevin bait is the preferred control method at this time in Utah.

Costs vary but usually average about $5 an acre for a minimum of 5,000 acres being sprayed. Some years there are government cost share programs to help spray large acres of rangeland. Usually, the land needs to border Federal or State lands to qualify for government aid. The insecticide most commonly used on rangelands is Malathion ULV applied at 8 oz. to the acre. It is important that spraying takes place early in the grasshopper’s life. The younger the grasshoppers are the better the kill rate. The best time to usually spray rangeland is the first three weeks in June. This is referred to as the "window of opportunity."

Cropland

The most profitable crops in Utah are alfalfa, corn, oats, wheat, rye, and barley. Grasshoppers concentrate in these croplands and destroy all vegetation present. This can be economically devastating for a farmer. Control on agricultural croplands is essential. As with rangelands you must determine whether there is an infestation of eight or more grasshoppers per square yard. If there is, then the two most effective control methods are ground spraying or aerial spraying. Ground spraying is usually more expensive per acre, but there is less chance of killing non-target insects (bees). Aerial spraying is quick, usually less expensive, and has a high kill rate. The disadvantage is the potential damage to non-target insects. Usually, aerial spray applications are used when there are a higher number of acres to be sprayed. Malathion ULV and Dursban are two common insecticides used for grasshopper control on agricultural croplands. Justification for control depends on the crop, the crop's stage of growth, additional migration, and the type of damages being done to the crop. Grasshoppers hatch and migrate off bordering lands, and at times this is extremely frustrating to an agriculture grower trying to control grasshopper infestation. This is where the importance of communities pulling together to do a countywide spray program comes into play. The importance of government spraying of public lands bordering cropland cannot be stressed enough.

Lawns, Gardens, and Landscaping

Homes are being built on lands that have produced grasshopper populations for many years. This causes problems for the homeowner. Grasshoppers are hatching and laying eggs in the lawns and gardens. This makes it possible for the grasshoppers to hatch on the same lawn year after year. Grasshoppers are

migrating out of vacant fields and low hills into the green, lawns and gardens. This results in thousands of dollars in damage to newly planted landscapes. It is very important that communities work together in controlling grasshopper outbreaks. If one person is spraying, and neighbors are not, then the grasshoppers will just continue migrating from adjacent property. Vacant lots and fields need to be tilled in late fall to expose the eggs. Eggs are destroyed when they are exposed to the cold environment. Lawns need to be raked to also expose the eggs. Flower gardens usually have a population of eggs, so the soil should be turned over to expose the eggs. If there is an outbreak of grasshoppers on your landscape during the summer, start spraying early. Once you see that grasshoppers have invaded, even the little ones, start spraying with Dursban (chlorpyrifos) for use on turf and ornamentals, Malathion for use on turf, ornamentals and vegetables, or liquid Sevin (carbaryl) for use on turf, vegetables, and ornamentals.

Insecticide baits that use insecticide such as Sevin have not been an effective barrier against the grasshoppers in Utah. Grasshoppers fly and jump great distances and more than likely will miss the barrier of bait completely. This bait is very effective for the Mormon crickets, common to the southern end of the county. READ AND FOLLOW THE INSTRUCTIONS ON PESTICIDE LABELS FOR REGISTERED USES, RATES, RESTRICTIONS, AND SAFETY PRECAUTIONS.
Conclusions

Grasshoppers are a recognized problem for Utah. The extreme infestations do not occur every year, but there are grasshoppers to some extent each year. Extreme infestations seem to come in cycles of seven years and last approximately three years. Everyone needs to recognize there is a problem, and take the steps each year to combat the insects. Expose the eggs as often as possible, start spraying late spring and early summer to kill the immature grasshoppers, make your spraying programs a community effort, and keep informed on government spray programs for your area. If everyone does their part we can greatly reduce the grasshopper populations, and strive for a county free of these devastating insects.

WEST NILE VIRUS

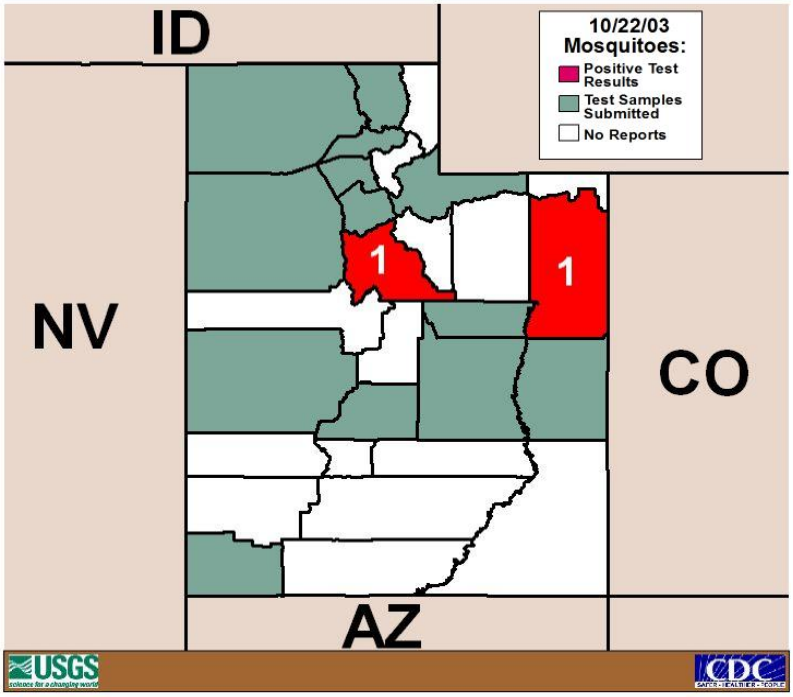
A second type of insect infestation is mosquito borne diseases. Most recently there has been significant news coverage of the West Nile Virus, although mosquitoes also carry other diseases. Other diseases carried by mosquitoes include various forms of encephalitis and dengue fever. The West Nile Virus and various forms of encephalitis may affect humans and animals.

Since West Nile virus (WNV) was first isolated in 1937, it has been known to cause asymptomatic infection and fevers in humans in Africa, West Asia, and the Middle East. Human and animal infections were not documented in the Western Hemisphere until 1999. In 1999 and 2000, outbreaks of WNV encephalitis (inflammation of the brain) were reported in persons living in the New York City metropolitan area, New Jersey, and Connecticut. In these two years, 83 human cases of West Nile illness were reported; 9 died. In 2001, human infection with WNV occurred in 10 states with 66 cases and 9 deaths. In 2002, WNV activity spread to 44 states, with 4,156 human cases and 284 deaths.

WNV is transmitted to humans through mosquito bites. Mosquitoes become infected when they feed on infected birds that have high levels of WNV in their blood. Infected mosquitoes can then transmit WNV when they feed on humans or other animals.

WNV is not transmitted from person to person and there is no evidence that handling live or dead infected birds can infect a person. But, to add a further level of safety, if birds or other potentially infected animals must be handled, a protective barrier (e.g., gloves, inverted plastic bags) should be used.

Most WNV infected humans have no symptoms. A small proportion develops mild symptoms that include fever, headache, body aches, skin rash and swollen lymph glands. Less than 1% of infected people develop more severe illness that includes meningitis (inflammation of one of the membranes covering the brain and spinal cord) or encephalitis. The symptoms of these illnesses can include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. Of the few people that develop encephalitis, a small proportion die but, overall, this is estimated to occur in less than 1 out of 1000 infections.



There is no specific treatment for WNV infection or vaccine to prevent it. Treatment of severe illnesses includes hospitalization, use of intravenous fluids and nutrition, respiratory support, prevention of secondary infections, and good nursing care. Medical care should be sought as soon as possible for persons who have symptoms suggesting severe illness.

Individuals can reduce their contacts with mosquitoes by taking these actions:

When outdoors, wear clothing that covers the skin such as long sleeve shirts and pants, apply effective insect repellent to clothing and exposed skin, and curb outside activity during the hours that mosquitoes are feeding which often includes dawn and dusk. In addition, screens should be applied to doors and windows and regularly maintained to keep mosquitoes from entering the home.

Regional Mitigation Goals

To coordinate with each participating local government to develop a regional planning process meeting each plan component identified in the FEMA Region VIII Crosswalk document and any additional State planning expectation, both regionally and specifically, as needed, by gathering local input. And to also meet the need of reducing risk from natural hazards in Utah, through the implementation of and updating of regional plans.

These goals form the basis for the development of the PDM Plan and are shown from highest priority, at the top of the list, to those of lesser importance nearer the bottom. The goals were approved at

Local Goals

- Protection of life before, during, and after the occurrence of a disaster.
- Preventing loss of life and reducing the impact of damage where problems cannot be eliminated.
- Protection of emergency response capabilities (critical infrastructure)
- Communication and warning systems
- Emergency medical services and medical facilities
- Mobile resources
- Critical facilities
- Government continuity
- Protection of developed property, homes and businesses, industry, education opportunities and the cultural fabric of a community, by combining hazard loss reduction with the community's environmental, social and economic needs.
- Protection of natural resources and the environment, when considering mitigation measures.
- Promoting public awareness through education of community hazards and mitigation measures.
- Preserving and/or restoring natural features that provide mitigation such as floodplains.

Long Term Goals

- Eliminate or reduce the long-term risk to human life and property from identified natural and technologic hazards.
- Aid both the private and public sectors in understanding the risks they may be exposed to and finding mitigation strategies to reduce those risks.
- Avoid risk of exposure to identified hazards.
- Minimize the impacts of those risks when they can not be avoided
- Mitigate the impacts of damage as a result of identified hazards.
- Accomplish mitigation strategies in such away that negative environmental impacts are minimized.
- Provide a basis for funding of projects outlined as hazard mitigation strategies.
- Establish a regional platform to enable the community to take advantage of shared goals, resources, and the availability of outside resources. If an earthquake occurs outside of Utah County it will still affect Utah County Communities this is similar to many natural hazards.

Objectives

The following objectives are meant to serve as a measure upon which individual hazard mitigation projects can be evaluated. These criteria become especially important when two or more projects are competing for limited resources.

- Identification of persons, agencies or organizations responsible for implementation of the goals.
- Projecting a time frame for implementation.
- Explanation of how the project will be financed including the conditions for financing and implementing as information is available.
- Identifying alternative measures, should financing not be available.
- Be consistent with, support, and help implement the goals and objectives or hazard mitigation plans already in place for surrounding counties.
- Be based on the Utah Vulnerability Analysis.
- Have significant potential to reduce damages to public and/or private property and/or reduce the cost of, state, and federal recovery for future disasters.
- Be the most practical, cost-effective, and environmentally sound alternative after consideration of the options.
- Address a repetitive problem, or one that has the potential to have a major impact on an area, reducing the potential for loss of life, loss of essential services and personal property, damage to critical facilities, economic loss, and hardship or human suffering.
- Meet applicable permit requirements.
- Not encourage development in hazardous areas.
- Contribute to both the short and long term solutions to the hazard vulnerability risk problem.
- Assuring the benefits of a mitigation measure is equal to or exceeds the cost of implementation.
- Have manageable maintenance and modification costs.
- When possible, be designed to accomplish multiple objectives including improvement of life-safety risk, damage reduction, restoration of essential services, protection or critical facilities, security or economic development, recovery, and environmental enhancement.
- Whenever possible, use existing resources, agencies and programs to implement the project

County Annexes

Summit County

Introduction

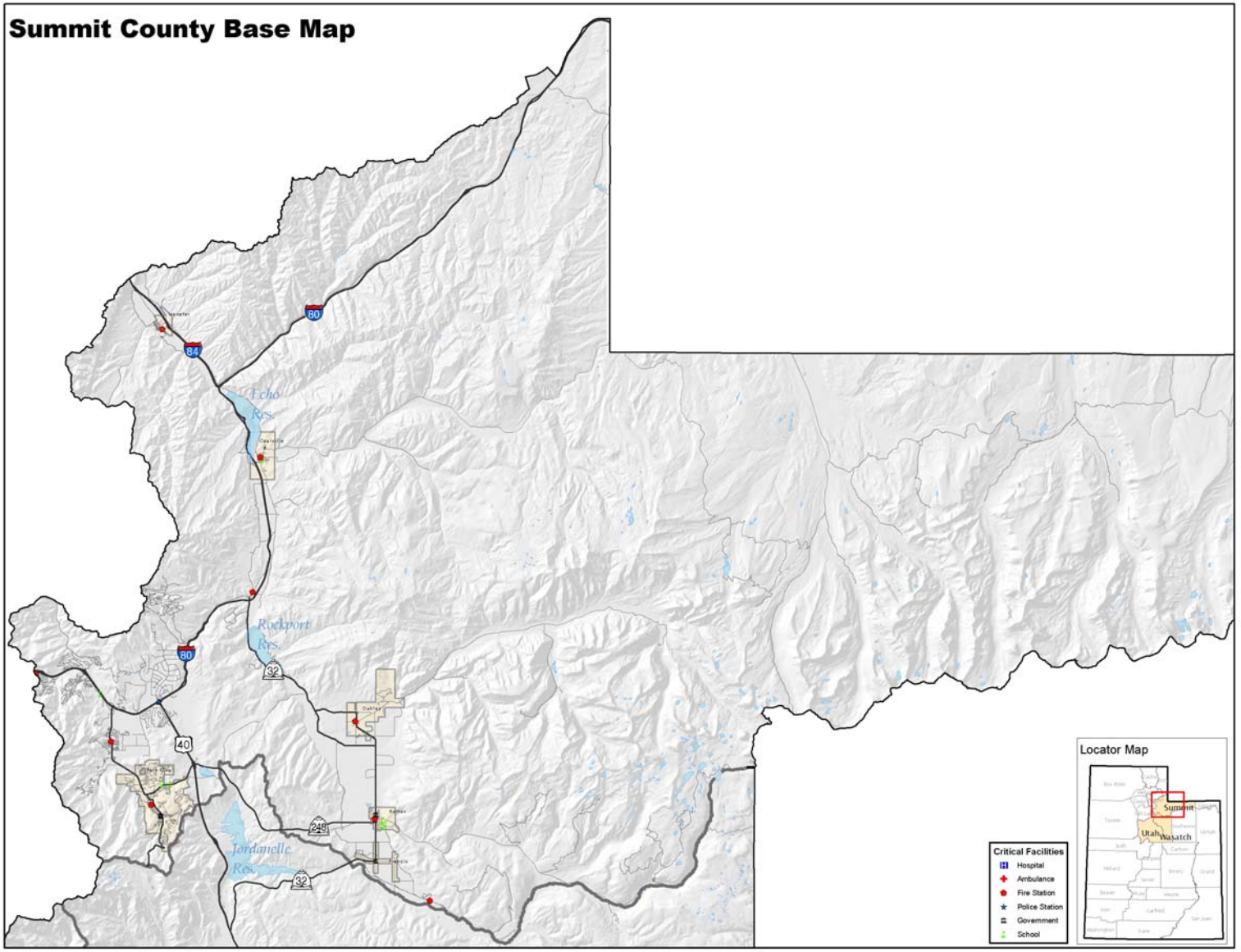
Area: 1,849 square miles; *population*: 29,736 (in 2000); *county seat:* Coalville; *origin of county name*: the county includes high mountain summits that form the divides of the Weber, Bear, and Green River drainage areas; *principal cities/towns*: Park City (7,371), Coalville (1,382), Kamas (1,274); *points of interest*: Park City area ski resorts, Park City Historic District, Rockport State Park, Echo Reservoir, High Uinta Wilderness Area; *economy*: skiing, tourism, lumbering, livestock.

Summit County was created in 1854 from Green River and Great Salt Lake counties. The Uinta Mountains dominate the eastern portion of the county, and the western section is a high back valley of the Wasatch Mountains.

The first white men to visit the area were fur trappers and traders in the 1820s and 1830s. Until the arrival of the Mormons in 1847, Summit County was hunting grounds for Northern Shoshone Indians. In 1846 Lansford W. Hastings, a California promoter, announced a new cutoff on the California Trail that would eliminate several hundred miles and many days of travel. The cutoff turned southwest from Fort Bridger, Wyoming, and entered Utah and the northeastern corner of Summit County through Echo Canyon. It followed the Weber River to Salt Lake Valley, went around the south shore of the Great Salt Lake, and then west into Nevada. The first group to take this new cutoff was the Donner-Reed party in 1846. Blazing a road through the Wasatch Mountains cost them many days, and when they reached the Sierra they ran into early snow, with well-known tragic results. Many lost their lives. A year later, the pioneering Mormons adopted part of the Hastings Cutoff, but when they reached the Weber River they turned southwest to Emigration Canyon. This became the main trail for the immigration of the Mormons to Utah. In 1869 the Union Pacific Railroad, builder of the eastern portion of the transcontinental railroad, followed the Hastings Cutoff, and today part of Interstate 80 follows the Hastings and Mormon trails and the Union Pacific route through northern Summit County.

The first settlers in Summit County arrived at Parley's Park in 1850. Wanship was settled in 1854, followed by Coalville, Hoytsville, and Henefer in 1859. When coal was discovered near Coalville, the Mormons established a mission there. During the 1860s, wagons hauled tons of coal from Coalville to the Salt Lake Valley settlements. In 1873 the Utah Eastern Railroad built a line from Echo Junction to Coalville to haul coal. This line eventually became part of the Union Pacific Railroad.

The discovery of silver, lead, and zinc in the Wasatch Mountains in the 1870s soon overshadowed the settlement and economic activities of the rest of the county. Park City, a mining town founded in 1872, continued to expand into the twentieth century. Many individuals made fortunes from the Park City mines. Mansions on South Temple in Salt Lake City reflect some of this wealth. Mining continued until the 1950s, at which time it no longer was profitable. For several decades Park City was on the verge of becoming a ghost town, but the area's rugged terrain and deep snow led to its rebirth as a winter sports center. Skiing currently is a major economic activity in western Summit County, while the rest of the county is still noted for its farming and ranching. Other recreational opportunities, including boating, fishing, and tourism add to the county's diversified economy. (Source: Utah Historical Encyclopedia, Craig Fuller, author)


Summit County Base Map
Echo Res.
Rockport Res.
Jordanelle Res.
80
84
40
32
248
Locator Map
Summit
Utah
Wasatch
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School

Population

The following table shows historic population data:

Table S-1

	1930	1940	1950	1960	1970	1980	1990	2000
Summit	9,527	8,714	6,745	5,673	5,879	10,198	15,518	29,736

Economy

Summit County has been the recipient of many new businesses, much residential and commercial development, and a thriving ski and tourism economy that defines its character and atmosphere. Summit County's local economy is largely driven by the activities of Park City and the Snyderville Basin. Its population has more than doubled since the initial OEDP was drafted. Eastern Summit County and its cities also face numerous growth and development pressures, although not exhibiting anywhere near the level of investment that is pushing the western half of the county. With numerous venues of the 2002 Winter Olympics within the Mountainland Region, economic growth should continue in the future.

Table S-2

Economic Indicators for Summit County
1997-2001

Summit County	1997	1998	1999	2000	2001	% Change 00-01
Population	26,224	27,674	28,799	30,048	31,279	4.1
Employment						
-Avg civilian labor force	12,984	13,701	14,250	14,517	15,092	3.7
-Avg non-ag employment	13,765	14,339	14,558	15,221	15,844	4.0
Income						
-Avg monthly non-ag wage	1,807	1,932	1,996	2,143	2,224	3.8
-Annual non-ag payroll ($000)	298,428	322,820	348,677	391,378	422,950	8.1
Total personal income ($Mil)	960	1,066	1,153	1,283	1,295	6.6
Per capita personal income	36,049	38,767	40,528	41,405	43,200	2.2
Taxes						
-Total assessed value ($Mil)	4,610	5,967	5,544	6,172	6,963	12.8
-Prop taxes charged ($000)	52,255	56,673	58,537	63,595	68,057	8.5
-Gross taxable sales ($000)	585,961	631,299	685,940	742,862	828,955	11.6
-Net local sales tax ($000)	4,705	5,012	5,399	5,813	6,391	10.0
Construction (permitted)						
-New Dwelling Units (#)	791	796	665	533	900	68.9
-Value of new res. ($000)	117,350	133,882	111,751	101,495	144,414	42.3
-Value new non-res ($000)	21,730	71,936	86,780	40,669	37,067	-8.9
-Value of total constr. ($000)	152,663	227,176	218,883	163,151	206,029	26.3
Miscellaneous						
-Fed mineral royalties ($000)	1,273	1,515	1,522	1,665	367	-18.4
-Fed in lieu of taxes ($000)	324	324	346	381	524	37.5

Source: Bureau of Economic and Business Research, University of Utah. www.business.utah.edu/bebr/Counties/summit.htm

Risk Assessment

Flood

Table S-3

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Summit	Unincorporated	17379		490134 - 7/17/86(M)	Weber and Provo Rivers & Tributaries
Summit	Coalville	1382	D5	490135 - (NSFHA)	Chalk Creek
Summit	Francis	698	D5	Not Participating**	Provo River
Summit	Henefer	684	C5	490136 - 5/20/80(M)	Weber
Summit	Kamas	1274	D5	490137 - (NSFHA)	
Summit	Oakley	948	D5	490138 - 9/24/84(M)	Weber
Summit	Park City	7371	D5	490139 - 7/16/87	Mcleod & Others

Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.
* D = Detailed Study Report and Map Prepared.
** Has not had flood hazards mapped by FEMA. Not participating in NFIP

Summit County Flood and Dam Failure History

Table S-4

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Summit	September 8, 1940	Echo/Henefer	Damage to Weber Canyon Highway and railroad tracks	
Flood Summit	August 11, 1941	Echo	Highway and railroad tracks	Landslides cover highway and railroad in five locations
Flood Summit	August 6, 1945	Hoytsville	Extensive damage to roads, buildings, farmlands, and crops	
Flood Summit	August 16, 1950	Heneger	Damage to ranches in vicinity of town	
Flood Summit	August 12,1961	Hoytsville/Echo	Damage to highways 189 and 30, and railroad tracks	Source Cottonwood Creek and Echo Cliff Wash
Flood Summit Presidential	Spring 1983	County Wide	Damage to roads, bridges, and culverts.	Source Chalk Creek Several landslides
		Coalville	City park, roads, sewage pump station, and drainage ditches.	12 private homes damaged
		Kamas	Roads, bridges, and sewer systems compromised.	
		Park City	Daly Avenue damaged flooding in Thaynes Canyon Subdivisions.	
Flood Summit Presidential	Spring 1984	County wide	$368,850 in damage. Wooden Shoe Road and Chalk Creek Road washed out.	

(All dollar values for given are for year of disaster)
Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.

The following table represents the estimated damage from a flood in Summit County. The data was collected from MAG's GIS.

Table S-5

Name	County	Population	Households	Value	Employment
Summit	Summit	142	44	$6,600,000	8

Summit County Flood Mitigation Goals

County-wide

Problem Identification: Flood occurs primarily from spring snow-melt and occasionally from localized summer thunderstorms. Identifying and then controlling flooding will assist in responding to flood events. Protection of life and property before, during, and after a flooding event is essential.

Goal 1 – Priority High

Objective 1.1 Encourage 100% participation in the National Flood Insurance Program (NFIP).

Action: Assist Town of Francis in joining NFIP
Time Frame: 1 year
Funding: None required
Estimated Cost: None
Staff: County Emergency Management, County Engineer, State Floodplain Manager
Background: FEMA has yet to map the Town of Francis with Special Flood Hazards (SFHA). The community does not participate in the NFIP therefore flood insurance is not available.

Objective 1.2 Promote flood insurance throughout the County

Action: Create outreach document promoting flood insurance and include in local newspaper(s), libraries, and other public buildings.
Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager, DES
Background: General public is usual not aware they can purchase flood insurance.

Objective 1.3 Reduce threat of unstable canals throughout the County. Identify County-wide canal systems

Action: Map and assess for structural integrity canal systems in the County
Time Frame: 3-5 years
Funding: Federal grants
Estimated Cost: Unknown
Staff: County Engineer, County Public Works, County Information and Technology, County Emergency Management

Background: Private and Public canals are used for transportation and dispersion of water as well as flood control.

Objective 1.4 Reduce flooding threat in Oakley, Woodland, Wanship, Hoytsville, Coalville, Peo, Francis and Henefer.

Action: Clear debris and other material from streams prior to spring snow melt.
Time Frame: Ongoing
Funding: None
Estimated Cost: Unknown
Staff: County Public Works
Background: Most flooding is attributed to debris-laden streams.

Objective 1.5 Ensure EOC(s) are equipped to respond to flooding.

Action: Obtain communication equipment that will allow for timely response to flooding.
Time Frame: 1 year
Funding: Federal Grants
Estimated Cost: $30,000
Staff: County Sheriff, County Emergency Management
Background: An alternate EOC is being considered in Kamas. Adequate communication capabilities are essential between all response agencies within the County.

Objective 1.6 Support updating of flood data

Action: Support and encourage participation in the NFIP Flood Map Mod Program.
Time Frame: Ongoing
Funding: Federal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager
Background: Accurate flood maps assist the County in the administration of the NFIP and better reflects flood risk within the County.

Mitigation Strategies

The following mitigation strategies are provided to inform communities of additional ways to mitigate hazards.

Prevention

- Planning and Zoning
- Floodplain open space preservation
- Building construction regulation
- Regulation of other facilities (critical)
- Stormwater management

Property Protection

- Relocation
- Acquisition
- Building elevation
- Flood proofing
- Lifeline protection
- Flood Insurance

Natural Resource Protection

- Wetlands protection
- Erosion and sediment control

Emergency Services

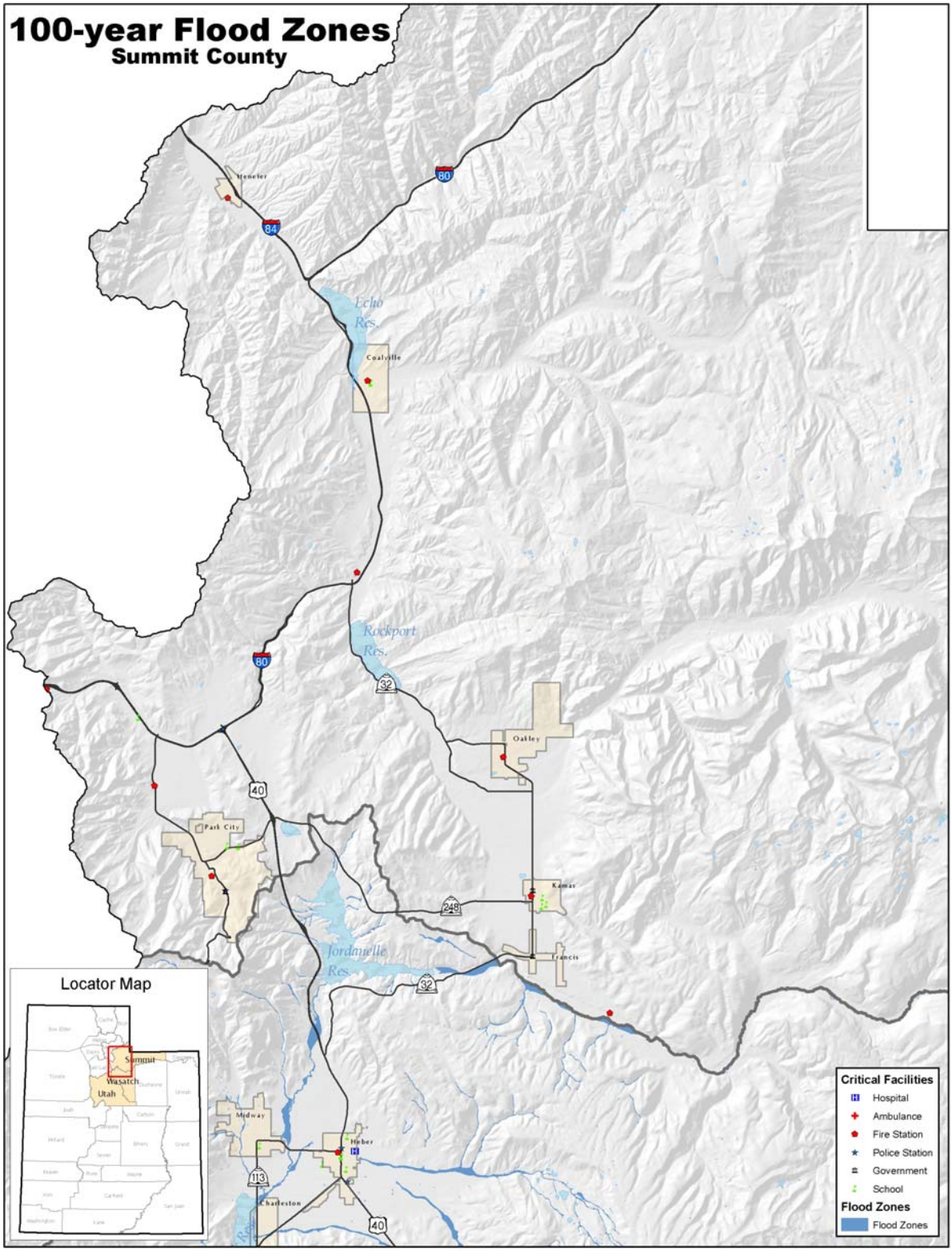
- Flood threat recognition
- Warning dissemination
- Flood response
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

Structural Projects

- Reservoirs/impounds
- Levees
- Diversions
- Channel and drainage modifications
- Channel and basin maintenance

Public information

- Flood Hazard maps
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Environmental education


100-year Flood Zones
Summit County
Meneler
Echo Res.
Coalville
Rockport Res.
Oakley
Park City
Kamas
Jordanelle Res.
Francis
Midway
Heber
Charleston
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Flood Zones
Flood Zones

Wildland Fire

Assessing Vulnerability

The following tables are taken from GIS data to determine the vulnerability of properties to wildfire damage.

Table S-6

City	County	Population	Households	Value	Employment
Coalville	Summit	550	163	$24,450,000	18
Francis	Summit	45	14	$2,100,000	0
Kamas	Summit	75	23	$3,450,000	1
Park City	Summit	1,932	643	$96,450,000	2,289
Summit	Summit	7,298	2,517	$377,550,000	3

Table S-7

Roads				
CITY	COUNTY	Type of Road	Length in Miles	Value
	Summit		6.42	$12,840,000
	Summit	Cloverleaf or interchange	3.68	$7,360,000
	Summit	Connecting road	9.29	$18,580,000
	Summit	Jeep trail,	4.63	
	Summit	Neighborhood roads	106.98	$213,960,000
	Summit	Neighborhood roads	0.07	$140,000
	Summit	Primary road, interstate highway	5.91	$21,276,000
	Summit	Primary road, interstate	0.08	$288,000
	Summit	Primary road, interstate	9.89	$35,604,000
	Summit	Primary road, interstate	0.19	$684,000
	Summit	Secondary road, U.S. highway	5.43	$13,102,590
	Summit	Walkway	1.53	$80,784
Coalville	Summit	Neighborhood roads	2.89	$5,780,000
Coalville	Summit	Walkway	0.5	$26,400
Kamas	Summit	Connecting road	0.01	$20,000
Kamas	Summit	Neighborhood roads	0.14	$280,000
Park City	Summit	Jeep trail	0.75	
Park City	Summit	Neighborhood	7.72	$15,440,000
		Total	166.11	$345,461,774

Table S-8

Utilities				
County	City	Type of Line	Length in Miles	Value
Summit	Park City	KV-46	1	$48,280
Summit		KV-12.5 or less	9	$434,520
Summit		KV-138	1	$48,280
Summit		KV-46	10	$482,800
Summit		Owned by others	10	$482,800
Summit		SUB-CO	0	
Summit		SUB-PP	0	
		Total	31	$1,496,680

Historic Fires

The following table identifies historic Wildfires in Summit County

Table S-9

FIRE_ID	YEAR	NAME	SDATE	CAUSE	COUNTY	TYPE	SIZE
2045-1999	1999	EMORY	11/3/1999	SM	Summit	Wildland	160.00
3382-2000	2000	DRY FORK	9/6/2000	MC	Summit	Wildland	200.00
3126-2000	2000	DRY BREAD	8/4/2000	LT	Summit	Wildland	250.00
1820-1999	1999	HARRIS CANYON	8/19/1999	LT	Summit	Wildland	300.00
3056-2000	2000	EAGLE CANYON 2	7/3/2000	DB	Summit	Wildland	410.00
2048-1999	1999	HENEFER LEDGES	10/24/1999	IN	Summit	Interfac	490.00
2049-1999	1999	LAMBS MEADOW	10/13/1999	CF	Summit	Wildland	600.00
3313-2000	2000	ECHO	7/21/2000	EQ	Summit		600.00
3433-2000	2000	FRANKLIN RIDGE	8/14/2000	MC	Summit	Interfac	3100.00
1347-1999	1999	EAGLE CANYON	7/24/1999	EQ	Summit	Interfac	3744.00

Overview

Wildfire is the most frequently occurring natural hazard within the Summit County area.

Development Trends

Much of the development occurring in Summit County and the jurisdictions in the county is in urban-wildland interface areas. Growth will occur on the urban fringe as well as resort properties near the ski areas of Park City.

Multi-Jurisdictional Risk Assessment

Most of the communities in Summit County are separated, however, wildfires may cross jurisdictional boundaries between communities and the unincorporated areas of rural Summit County.

Problem Identification: Continuing non-compliance with Fire-wise development "Best Practices".

Goal 1 – Priority High

Objective 1.1 Increase compliance with existing building and fire codes.

Action: Develop and enforce current local, state and national codes
Time Frame: Ongoing
Funding: Local, state and federal grants
Estimated Cost: Unknown
Staff: Local, state and federal agencies
Background: Implement and enforce rules, regulations and codes

Problem Identification: Building continues to be of concern in Urban Wildfire Interface Areas (URWIN). Especially in the following areas: Pine Mountain – Oakley, Samak – Kamas, Sage Mountain – Echo, Mountainland and developed areas near Bear River Service on Mirror Lake Highway.

Goal 2 – Priority High

Objective 2.1 Educate homeowners on how to reduce risk of wildfire damage

Action 1: Conduct an education program (Firewise) on reducing wildfire risks
Time Frame: Ongoing
Funding: County
Estimated Cost: Minimal
Staff: Fire District(s), County Emergency Management, State FFSL
Background: Educate homeowners using newsletters and personal contacts of the importance of clearing combustibles from perimeters of their homes

Action 2: Develop a firebreak road in Pine Mountain Subdivision in Oakley
Time Frame: 3 years
Funding: County, State and Federal
Estimated Cost: Unknown
Staff: Private land owners, County Public Works, County Emergency Management, Fire District, State Forestry Fire and State Lands, US Forest Service
Background: Wildfires have the potential to threaten this area. This will assist in protecting the community by providing a firebreak

Action 3: Continue to work with current Firewise communities (Pinebrook, The Colony's, Summit Park) on their wildfire risks
Time Frame: Ongoing
Funding: County, State and Federal Grants
Estimated Cost: Minimal
Staff: County Emergency Management, State FFSL, US Forest Service
Background: It is essential we continue to promote wildfire mitigation actions and educate homeowners on wildfire risks.

Mitigation Strategies–Wildland Fire

The following mitigation strategies are examples that could be used to limit the exposure to Wildland Fire related damage.

Prevention

- Zoning ordinances to reflect fire risk zones
- Regulate development areas near fire protection and water resources
- Planning to include: spacing of buildings, firebreaks, on-site water storage, wide roads, multiple access
- Code standards for roof materials and fire protection systems
- Maintenance programs to clear dead and dry brush
- Regulations on open fires
- Open space around structures

Property Protection

- Retrofitting roofs, add spark arrestors
- Create and maintain defensible space
- Insurance
- Eliminate ladder fuels
- Install sprinkler systems
- Develop fire resistant plans
- Have home addresses clearly displayed
- Clean out rain gutters

Natural Resource Protection

- Require mitigation of development in high-risk areas
- Understand impact of non-native vegetation
- Promote tread soft ATV use
- Develop watershed management plans
- Maintain watersheds
- Establish and promote fuel reduction

Emergency Services

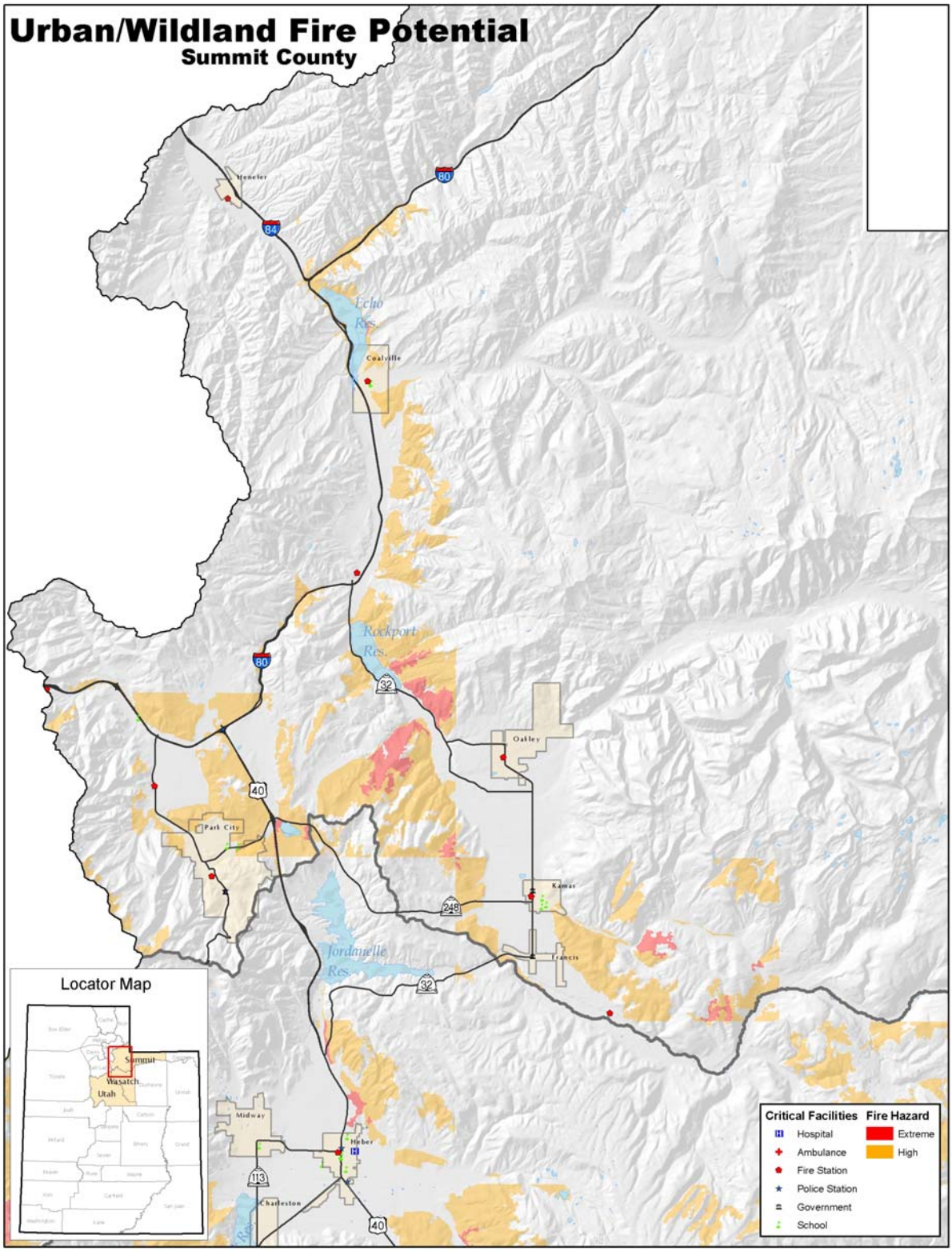
- Mutual aid agreement for fire fighting
- Participate in State Wildfire Suppression Fund
- Develop and exercise local wildfire response plan and evacuation plans

Structural Projects

- Construct wildfire fuel breaks
- Install Heliport water stations
- Tree and underbrush thinning in critical areas
- Increase the number of fire hydrants
- Install water tanks

Public information

- Develop maps for wildfire hazard areas
- Mail wildfire information to owners high-risk structures
- Develop urban wildfire “How to protect your home from Wildfires” book
- Publish newspaper articles on wildfires
- Presentations on wildfires at community meetings
- Develop displays for public buildings and events
- Real estate disclosure of high hazard wildland fire area


Urban/Wildland Fire Potential
Summit County
Meneler
Echo Res.
Coalville
Rockport Res.
Oakley
Park City
Kamas
Jordanelle Res.
Francis
Midway
Heber
Charleston
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Fire Hazard
Extreme
High

Landslide/Problem Soils

Assessing Vulnerability

No electronic data is currently available to determine the vulnerability for problem soils within the Summit County area based on a GIS analysis. It is assumed that the resort communities of Park City and the Snyderville basin will have potential problems with landslides. Due to the high value of much of the development occurring in the area, measures should be taken to reduce the potential for loss.

Development in areas suspected to have soils or landslide issues should be required to have geo-technical studies at the time of development review.

The following table was prepared from a GIS overlay to identify potential losses associated with landslides.

Table S-10
Active Landslides

County	City	Total population	Total houses	Description
Summit		1306	442	Deep Seated
Summit		719	230	LS and LS/talus/colluvial/etc
Summit	Coalville	0	0	Deep Seated
Summit	Coalville	0	0	LS and LS/talus/colluvial/etc
Summit	Oakley	61	17	Deep Seated
Summit	Park City	1092	466	Deep Seated

Development Trends

The area around Park City is known for its destination resort quality views. Much of the economy of the area is based on the snow ski industry. Future development will most assuredly be related to scenic views and resort development. Any areas of potential landslide or problem soils should be addressed in a site-specific geo-technical study.

Mitigation Strategies

Problem Identification: There is a potential risk to structures located in areas identified by the MAG GIS as landslide risk areas.

Goal 1 – Priority Medium

Objective 1.1 Reduce potential landslide risk on commercial, residential structures, and infrastructure (pipelines and utilities) in areas of known landslide potential.

Action 1: Assess the probability of landslides and identify specific structures and infrastructure at risk
Time Frame: Undetermined
Funding: County Engineer, County Emergency Management, County Public Works, Utilities, Developers and Property Owners
Estimated Cost: Unknown
Staff: Unknown

Background: Soil surveys and other engineering surveys are needed.

Action 2: Include landslide data in County Information and Technology GIS system and include on County website.
Time Frame: Undetermined
Funding: County, possible grants
Estimated Cost: To be determined
Staff: County GIS Staff, UGS,
Background: General public and developers will have access to landslide data.

The following mitigation strategies are provided to inform communities of possible measures that could be used to limit the exposure to landslide/Problem Soils related damage.

Prevention

- Planning and zoning restrictions and regulations
- Open Space
- Building Codes
- Drainage system maintenance
- Monitor and evaluate areas after wildfire
- Install ground monitoring instruments on landslide-prone areas
- Establish codes (grading, construction, excavation) in landslide prone areas

Property Protection

- Insurance
- Remove soil
- Ensure rain gutters and sprinklers are directed away from structures
- Control and monitor surface and ground water drainage
- Control building in areas of landslides
- Evaluate property maintenance in areas of landslides (over watering)
- Plan proper valving of waterlines to ensure quick turn off in the event of a waterline break

Natural Resource Protection

- Leave area as open space
- Identify structures impacted by problem soils
- Complete a watershed management plan
- Limit use of ATVs in areas off landslides to manage erosion
- Evaluate impact of wildfire in areas of landslides
- Mitigate development in landslide-prone areas
- Maintain natural vegetation

Emergency Services

- Identify structures impacted by problem soils
- Monitor and warning systems
- Evacuation plans and exercises
- Critical Facilities Protection
- Equip emergency crews with water valve shut-off keys

Structural Projects

- Pre-soak and/or compact soils
- Install drain fields
- Bring in structural fill
- Build buttress, retaining walls and other engineered structures
- Install subsurface drainage materials
- Remove potential landslide debris

Public information

- Develop information on problem soils
- Outreach information on problem soil mitigation
- Map soils and landslide areas
- Real estate disclosure
- Notice to homeowners in landslide areas detailing hazard
- Library
- Technical Assistance
- Education

Earthquake

Assessing Vulnerability

Please see the HAZUS-MH Earthquake event report for Summit County 2500 year event, print date October 20, 2003 in the appendix of this document for full details of vulnerability. According to the HAZUS-MH run, about 42% or 6,284 will be damaged and that 516 will be completely destroyed. It must however be noted that Summit County lies outside of the Wasatch Fault and that there have only been 8 earthquakes in recorded history, none of which have caused any significant damage.

The geographical size of the region is 1,879.18 square miles and contains 5 census tracts. There are over 10 thousand households in the region and has a total population of 29,736 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 14 thousand buildings in the region with a total building replacement value (excluding contents) of 2,980 (millions of dollars). Approximately 99.00 % of the buildings (and 87.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,245 and 326 (millions of dollars) , respectively.

Critical Facility Inventory

HAZUS breaks critical facilites into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 16 schools, 2 fire stations, 2 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 46 dams identified within the region. Of these, 11 of the dams are classified as ‘high hazard’. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plant

Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data is provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,571.00 (millions of dollars). This inventory includes over 262 kilometers of highways, 156 bridges, 0 kilometers of pipes.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows:

Severity Level 1: Injuries will require medical attention, but hospitalization is not needed.
Severity Level 2: Injuries will require hospitalization but are not considered life threatening.
Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum and 5:00 PM represents peak commute time.

The following table forecasts the number of casualties that might be expected if an earthquake occurred.
Table S-11

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	3	1	0	0
	Commuting	0	0	0	0
	Education	0	0	0	0
	Hotels	10	3	0	1
	Industrial	3	1	0	0
	Residential	31	7	1	2
	Single Family	108	26	4	7
	Total	156	38	5	10
2 PM	Commercial	198	57	9	18
	Commuting	0	0	0	0
	Education	42	12	2	4
	Hotels	2	1	0	0
	Industrial	25	7	1	2
	Residential	5	1	0	0
	Single Family	16	4	1	1
	Total	287	82	13	26
5 PM	Commercial	146	42	7	13
	Commuting	0	0	0	0
	Education	4	1	0	0
	Hotels	3	1	0	0
	Industrial	16	4	1	1
	Residential	12	3	0	1
	Single Family	42	10	1	3
	Total	223	62	10	19

Building Damage

HAZUS estimates that about 6,284 buildings will be at least moderately damaged. This is over 42% of the total number of buildings in the county. There are an estimated 516 buildings that will be completely destroyed. The following table summaries the expected damage by general occupancy for the buildings in the county.

Table S-12

Type	None	Slight	Moderate	Extensive	Complete
Agriculture	0	0	0	0	0
Commercial	17	24	46	32	16
Educational	0	0	0	0	0
Governmental	0	0	0	0	0
Industrial	1	2	4	3	1
Religion	1	1	1	1	0
Residential	126	234	339	237	91
Single Family	3,269	4,951	4,077	1,030	407
Total	3,413	5,212	4,467	1,302	516

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were $511,700,000; 11% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up over 73% of the total loss.

Critical Facilities

Table S-13

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	0	0	0	0
Schools	16	0	0	0
EOCs	0	0	0	0
Police Stations	2	0	0	0
Fire Stations	2	0	0	0

Development Trends

Due to Summit County being outside of the Wasatch Fault the potential for earthquakes is very low. Since there is a low potential for earthquakes, current development trends do not increase the vulnerability to earthquake damage.

The following table shows recorded earthquakes occurring in Summit County of Richter magnitude 3.0 or greater since 1950.

Table S-14

Date	Richter Magnitude	Epicenter
July 27, 1965	3.7	East of Park City
February 7, 1972	3.1	Near Kimball Junction

Problem Identification: Summit County will be impacted indirectly from an earthquake on the Wasatch Front. Transportation and utilities services to and from the County could be severely impacted.

Goal 1 – Priority Low

Objective 1.1 Provide for emergency response and relief

Action: Identify and maintain critical transportation and utility services
Time Frame: Ongoing
Funding: Grants
Estimated Cost: Unknown- Determined by the extent of damage anticipated.
Staff: County
Background: Critical transportation systems need to be maintained.

Problem Identification: Lack of public awareness about earthquake damage prevention practices.

Goal 2 – Priority Medium

Objective 2.2 Through the CERT Program, educate community on earthquake damage prevention practices

Action: Educate the public on damage prevention practices for earthquakes
Time Frame: 2 years
Funding: State and Federal Grants from state and Federal governments
Estimated Cost: $50,000-$75,000
Staff: County Emergency Management and volunteers
Background: Continue to support C.E.R.T. program in the County. Earthquakes preparedness techniques and guidelines can be utilized in an all-hazard approach to personal and individual preparedness.

Mitigation Strategies

The following mitigation strategies are provided to suggest additional measures that communities could use to limit the exposure to earthquake related damage.

Prevention

- Planning and Zoning
- Building construction regulation

Property Protection

- Non-structural methods
- Retrofit upgrades
- Earthquake Insurance

Natural Resource Protection

- Identify Fault Rupture zones
- Identify secondary impact

Emergency Services

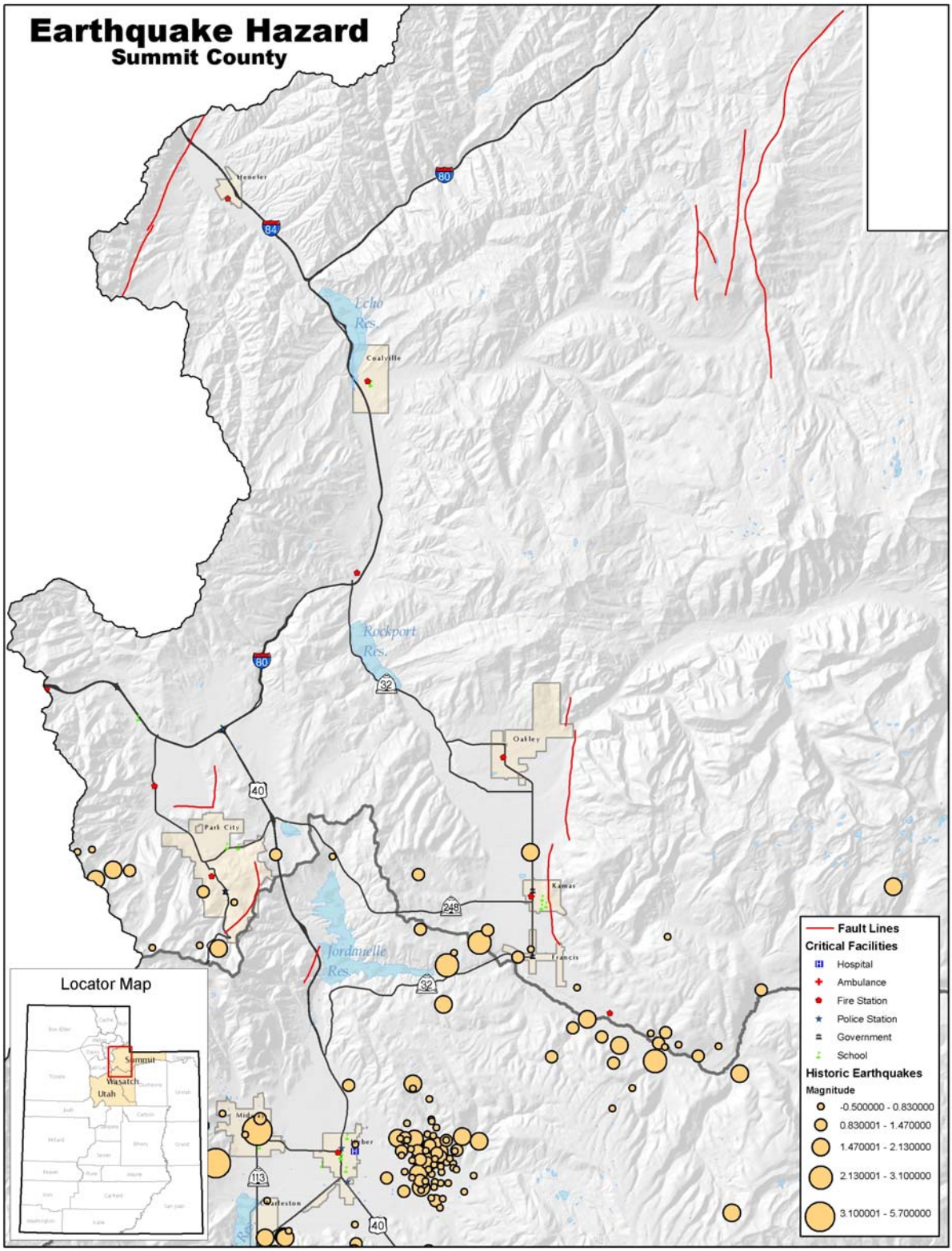
- Earthquake threat recognition
- Emergency Planning for Secondary Impact
- Emergency response (Mutual Aid, CERT)
- Critical Facilities Protection

Structural Projects

- Rebuild or retrofit critical facilities to higher seismic code
- Rebuild or retrofit infrastructure to higher seismic code

Public information

- Seismic maps; liquefaction, fault zones
- Map Information
- Outreach projects
- Real estate disclosures
- Technical Assistance
- Education


Earthquake Hazard
Summit County
Meneler
Echo Res.
Coalville
Rockport Res.
Oakley
Park City
Kamas
Jordanelle Res.
Francis
Midway
Charleston
Locator Map
Summit
Wasatch
Utah
Fault Lines
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Historic Earthquakes
Magnitude
-0.500000 - 0.830000
0.830001 - 1.470000
1.470001 - 2.130000
2.130001 - 3.100000
3.100001 - 5.700000

Drought

Assessing Vulnerability

Drought is a region-wide cyclical hazard that varies little among the three counties in the MAG area. The vulnerability will typically be related to agricultural production. A secondary affect of drought is the increase in vulnerability to wildfires. Many of the communities in the region have dealt with drought for a number of years. These communities have several sources for water and storage facilities. Many of the communities have secondary water systems to reduce the demand on culinary water resources. Many communities also have active water conservation programs in place.

County-wide

Problem Identification: Cyclical periods of drought place a strain on community culinary water resources.

Goal 1 – Priority Low

Objective 1.1 Conserve culinary water by educating the public

Action 1: Educate the public on the need to be water wise
Time Frame: Ongoing
Funding: State and Federal
Estimated Cost: Minimal
Staff: Water Districts
Background: Use a newsletter to educate the public

Action 2: Coordinate with current water systems and develop a secondary water systems plan for drought
Time frame: Immediate
Funding: Undetermined local sources
Estimated Cost: Minimal
Staff: Water Districts
Jurisdictions: Countywide
Background: To reduce the demand on culinary systems it is proposed that more communities study the possibility of using secondary water for agricultural uses such as irrigation and lawn watering.

Mitigation Strategies

The following mitigation strategies are provided to illustrate measures communities could use to limit the exposure to drought related damage.

Prevention

- Establish economic incentives for water conservation
- Encourage water conservation
- Develop early warning system, monitoring programs
- Implement water metering and leak detection programs

Property Protection

- Identify potential for wildfire due to drought
- Identify secondary effects from drought
- Drought Insurance

Natural Resource Protection

- Legislation to protect stream flows
- Protect water aquifers
- Alert procedures for water quality issues
- Create inventory of pumps, filters and other equipment

Emergency Services

- Establish water hauling programs
- List livestock watering locations
- Establish hay hotline
- Fund water system improvements (wells, systems, reservoir)
- Lower well intakes
- Develop drought contingency plans
- Issue emergency permits for water use

Structural Projects

- Redesign or create new reservoir storage
- Provide pumps and piping for distribution

Public information

- Develop drought education material
- Water conservation outreach material
- Other outreach for awareness

Severe Weather/Avalanche

Assessing Vulnerability

Severe weather conditions and/or avalanche occur in Summit County on a regular basis, however most of the losses are limited. Most of the deaths occur to either backcountry skiers or to skiers skiing out-of-bounds. Search and rescue operations to find buried skiers costs tax payers significant dollars as well as put lives of emergency workers in harm's way. Education of skiers on the dangers of avalanches could go along way toward reducing avalanche deaths. Severe weather may cause closure of transportation routes and fatalities due to weather related vehicular accidents. The ski resorts count on winter storms to produce the snow pack needed to operate their businesses. Some of the ski runs are located in avalanche prone areas, the private ski resorts as well as county public works and state road crews are aware of the potential dangers and keep the avalanche danger to a minimum.

The following table shows recorded damaging snow avalanches that have occurred in Summit County since 1864:

Table S-16

Date	Location	Remarks
February 18, 1884	Park City	Three Deaths
January 21, 1886	Park City	Three Deaths
December 31, 1965	Park City Ski Area	One Death

The following table shows recorded deaths from lightning since 1954:

Table S-17

Date	Location	Remarks
August 2, 1991	Island Lake	Two deaths, standing under tree
July 18, 1997	Cliff Lake	One death, hiking back to camp
July 19, 2003	Crystal Lake Trailhead	Two deaths, sitting under tree
August 14, 2003	Near Dead Horse Lake	One death, hiking on trail

Problem: Snowstorms, summer thunderstorms, hail, and high winds over northern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 1 – Priority High

Objective 1.1 Protect County from adverse affects of severe weather

Action 1: County participation in the StormReady program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service StormReady program.

Action 2: Encourage avalanche preparedness for county backcountry users.
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal
Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Jurisdictions: Countywide
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry. While the avalanche terrain is mainly on US Forest Service land the search and rescue for the lost individual in more often than not coordinated by emergency managers with search parties comprised of county and city staff. Introductory avalanche awareness training could lessen the costs to Summit County and the cities within the county. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOCs to ensure they are grounded lightning, to include buildings with towers, etc.
Time frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Jurisdictions: Countywide
Background: Proposed alternate EOC (Kamas), Sheriff's Dispatch, Command Vehicle(s)and associated equipment need to be protected from sever weather events including lightning.

Mitigation Strategies

The following mitigation strategies are provided inform communities of additional methods that could be used to limit the exposure to Severe Weather/Avalanche related damage.

Prevention

- Early warning and notification systems
- Building codes to address wind shear and snow load
- Properly ground structures for lightning
- Public education for severe weather conditions
- Restrict development in avalanche prone areas

Property Protection

- Structural tie downs of roofs in high wind areas
- Mitigate development in areas of avalanche potential
- Monitor NWS weather warnings and watches

Natural Resource Protection

- Evaluate the impacts of severe weather
- Mitigate development in areas of avalanche

Emergency Services

- Monitor NWS weather warnings and watches
- Develop plans and exercises for severe weather

Structural Projects

- Install sheds over roads below avalanche terrain
- Install drift fences along snow drift areas
- Install avalanche fencing along ridgelines for wind blown snow
- Promote Weatherization programs

Public information

- Develop outreach document on avalanche safety
- Become a NWS Storm Ready Community
- Promote Lighting Safety Week
- Develop cold weather safety materials
- Ensure that at risk groups, such as the elderly, are checked on during severe weather

Infestation

Assessing Vulnerability

The vulnerability for infestation damage to the Summit County area varies little from the regional assessment above.

The following table identifies the mitigation strategies that are the top priority for each community. The mitigation strategies where prioritized based on GIS data. The hazard identified with the highest number of household potentially affected was designated the highest priority.

Summit County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES
Table S-18

Community	Hazard	Mitigation	Cost	Responsible party	Funding Source
Coalville	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunters
Francis	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Henefer	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Kamas	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Oakley	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Park City	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Summit County	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunters

Utah County

Area: 2,014 square miles; *population*:368,536 (in 2000); *county seat*: Provo; *origin of county name*: after the Ute Indians; *principal cities and towns*: Provo (105,166); Orem (84,324); Pleasant Grove (23,468); American Fork (21,941); Spanish Fork (20,246); Springville (20,424); Lehi (19,028); Payson (12,716); *economy*: steel industry, light manufacturing, agriculture; *points of interest*: Fairfield Stagecoach Inn, historic downtown Provo, Brigham Young University (Monte L. Bean Life Sciences Museum, Museum of People and Culture, Harris Fine Arts Center), Utah Lake, Timpanogos Cave National Monument, Springville Museum of Art, Hutchings Museum of Natural History in Lehi, McCurdy Historical Doll Museum in Provo, Bridal Veil Falls, Sundance ski resort.

The most striking geographical features of Utah County are the Wasatch Mountains along the eastern boundary, and Utah Lake, the state's largest fresh-water lake. The high mountains, rising over 11,000 feet, receive heavy snowfall which feeds the numerous rivers and creeks that flow into the lake. Though large in surface area, Utah Lake is very shallow--18 feet at its deepest point.

Before the valley was settled by Mormon pioneers in the 1840s and 1850s it was the home of the Ute Indians. They lived along the eastern shore of the lake and used fish from the lake as their main food source. The Spanish Catholic priests Dominguez and Escalante, who observed them in 1776, described these Indians as peaceful and kind. Dominguez and Escalante were trying to find a route between Santa Fe, New Mexico, and what is now southern California. When they came down Spanish Fork Canyon in the summer of 1776 they were the first non-Indians to enter Utah Valley.

Mormon pioneers began settling Utah Valley in 1849. Like the Indians before them, they chose to settle on the fertile, well-watered strip of land between the mountains and Utah Lake. More than a dozen towns were established between Lehi on the north and Santaquin on the south. Provo, named for the French fur trapper Etienne Provost, has always been the largest town and the county seat.

In March 1849 thirty-three families, composed of about 150 people, were called to go to Utah Valley under the leadership of John S. Higbee to fish, farm, and teach the Indians. During the next two years - 1850 and 1851 - communities were established at Lehi, Alpine, American Fork, Pleasant Grove, Springville, Spanish Fork, Salem, and Payson.

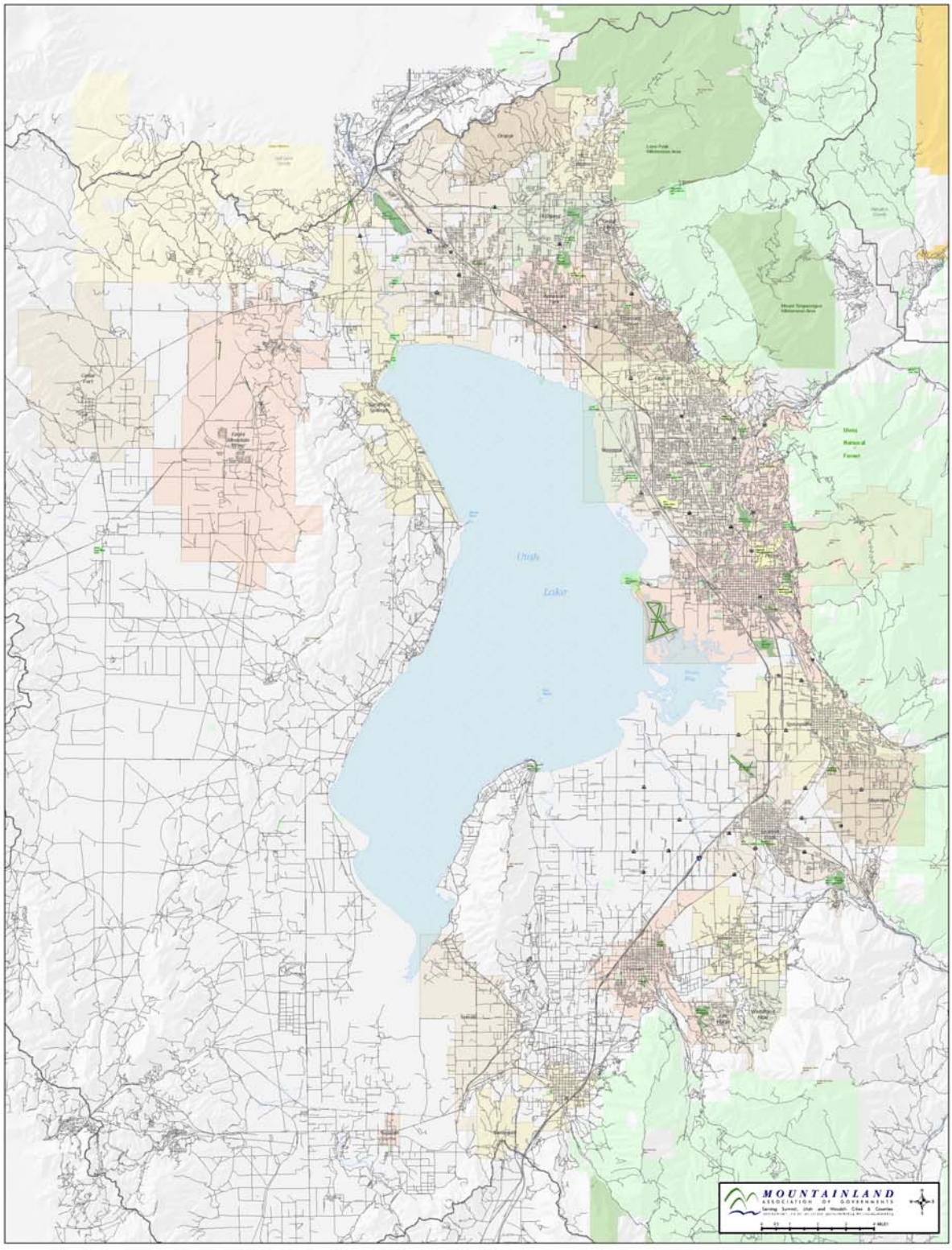
Farming was the most important early industry in the county, with fruit growing and the processing of sugar beets being especially important. The first large-scale sugar beet factory in Utah was built in Lehi in 1890. In recent years, the center of the fruit industry in the county has shifted from Orem to the south end of the valley, where orchards are not threatened by housing developments.

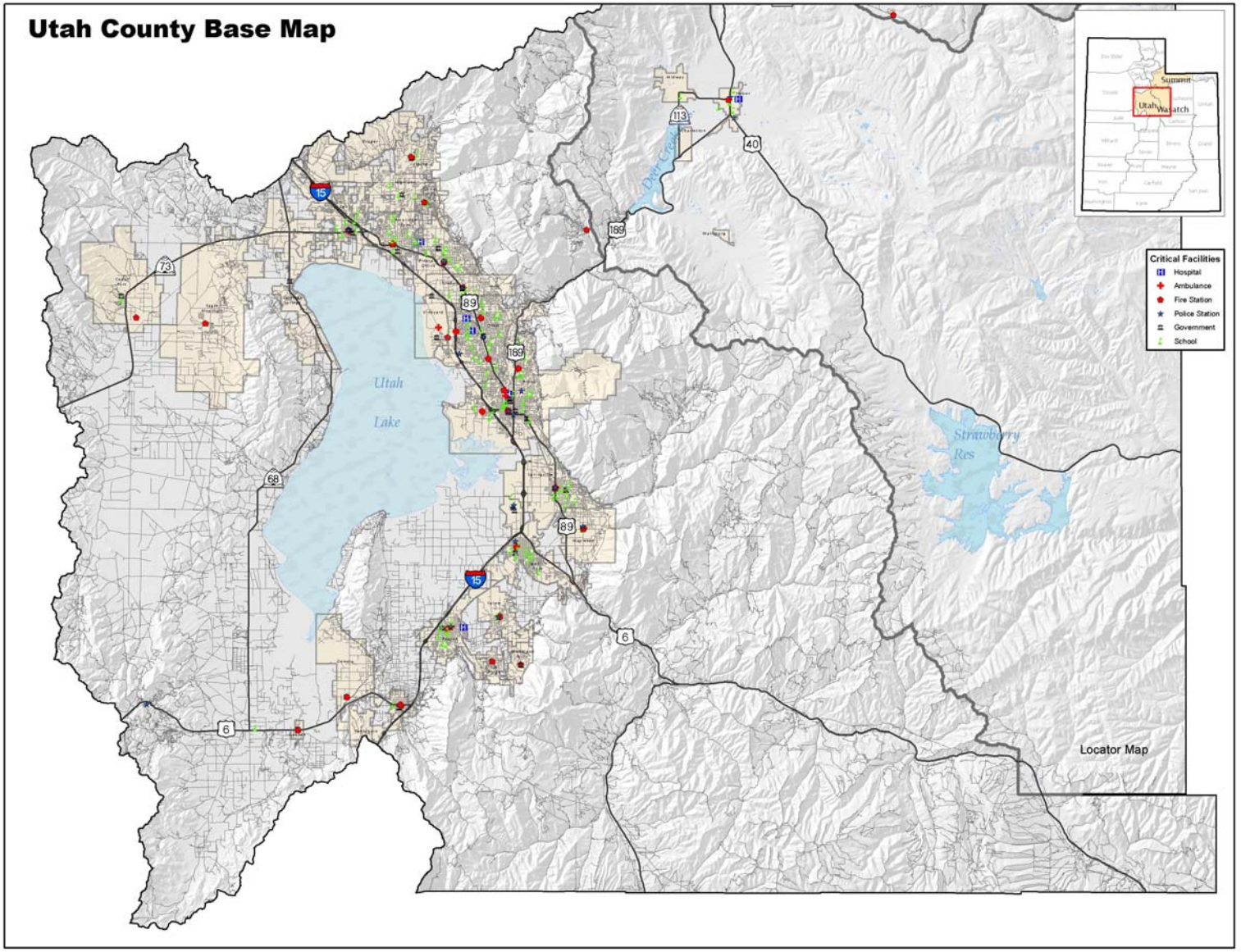
Mining was also an important industry in Utah County. In the late 1800s and early 1900s there were many successful mines in American Fork Canyon and in the Tintic mining district centered near Eureka, Juab County but included part of western Utah County. Many of the fine homes and business buildings in Provo were constructed with mining money.

Today, Utah County is best known as the home of the Geneva steel plant and Brigham Young University. Geneva was constructed at this inland location during World War II in case the steel plants near the coast were destroyed in the war. BYU was established in 1875 as a small high-school level "academy," but it has grown to become a major university with 27,000 students. The Utah Valley Community College at Orem has grown rapidly and plans are being developed to make the institution a four year college. Other

major Utah County employers include WordPerfect Corporation and Novell, two companies that began in Utah County and have become international leaders in the computer software industry.

Each of the major communities in the county have high schools and libraries. A culturally active area, the county has its own symphony--the Utah Valley Symphony, and one of the state's finest art museums: the Springville Art Museum. Provo's Fourth of July Celebration is the largest in the state and other special community celebrations include Pleasant Grove Strawberry Days, the Lehi Round-up, Steel Days in American Fork, Fiesta Days in Spanish Fork, Golden Onion Days in Payson, and the World Folkfest in Springville. (Source: Utah Historical Encyclopedia; Roger Roper, Author)


Utah
Lake
MOUNTAINLAND
ASSOCIATION OF GOVERNMENTS


Utah County Base Map
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Utah
Lake
Strawberry
Res
Locator Map
Summit
Utah
Wasatch
15
73
89
189
68
6
40
113

Population

The following table shows historic population data:

Table U-1

	1930	1940	1950	1960	1970	1980	1990	2000
Utah	49,021	57,382	81,912	106,991	137,776	218,106	263,590	368,536

Economy

Table U-2

Economic Indicators for Utah County 1997-2001						
Utah County	1997	1998	1999	2000	2001	% Change 00-01
Population	334,658	344,820	358,463	371,894	385,692	3.7
Employment						
-Ave civilian labor force	153,912	159,751	164,930	169,890	172,455	1.4
-Ave non-ag employment	135,148	141,691	146,724	152,747	154,058	.9
Income						
-Ave monthly non-ag wage	1,907	1,998	2,102	2,215	2,243	1.3
-Annual non-ag payroll ($Mil)	3,093	3,398	3,701	4,057	4,147	2.2
Total personal income ($Mil)	5,600	6,141	6,550	7,088	7,393	4.3
Per capita personal income	16,450	17,380	18,114	19,128	19,170	.2
Taxes						
-Total assessed value ($Mil)	11,229	11,825	11,460	12,811	14,357	12.1
-Prop taxes charged ($000)	127,708	129,646	126,218	137,956	153,870	11.5
-Gross taxable sales ($Mil)	3,264	3,670	3,939	4,171	4,327	3.8
-Net local sales tax ($000)	34,597	36,749	39,751	42,681	45,213	5.9
Construction (permitted)						
-New Dwelling Units (#)	3,291	4,146	4,111	3,898	4,272	9.6
-Value of new res. ($000)	327,293	422,156	481,103	503,210	576,294	14.5
-Value new non-res ($000)	229,722	139,423	160,099	154,361	167,323	8.4
-Value of total constr. ($000)	619,722	657,853	721,693	743,135	824,155	10.9
Miscellaneous						
-Fed mineral royalties ($000)	52,415	132,179	160,286	100,320	132,832	32.4
-Fed in lieu of taxes ($000)	458	478	488	519	761	46.7

Source: Bureau of Economic and Business Research, University of Utah.
www.business.utah.edu/bebr/Counties/utah.htm

Flood/Dam Failure

Assessing Vulnerability

Overview

Although Utah is considered a dry desert state, flooding does occur. Most floods are occur either from snow melt or severe thunderstorms. Often times flooding is increased by soils that are more impervious due to either wildfire or drying out. Floods occur on a regular basis in Utah County.

Development Trends

As development occurs on the bench areas of Utah Valley, along the shore of Utah Lake, or along river and stream corridors more homes will be in danger of floods. Communities need to make developers and homeowners aware of the danger. Cities should review every development that it is in compliance with NFIP guidelines.

The following table identifies the communities in Utah County with their NFIP Status.

Table U-3

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS*	THREAT (or NSFHA-eligible)
Utah	Unincorporated	17638		490517 - 12/15/94	Utah Lake & Tributaries
Utah	Alpine	7146	E5	490228 - 4/4/83	
Utah	American Fork	21941	E5	490152 - 11/25/80(M)	
Utah	Cedar Fort	341	E4	490153 - (NSFHA)	
Utah	Cedar Hills	3094	D5	Not Participating	Heisett's Hollow & Other drainages
Utah	Eagle Mountain	2157	D4	Not Participating	Tickville Gulch &Tributaries
Utah	Elk Ridge	1838	E5	Not Participating	Loafer Canyon & Others drainages
Utah	Genola	965	E5	490154 - (NSFHA)	
Utah	Goshen	874	F4	Not Participating	City Ditch (minor)
Utah	Highland	8172	D5	490254 - 2/4/02	
Utah	Lehi	19028	E5	490209 - 3/1/83	
Utah	Lindon	8363	E5	490210 - 2/19/86(M)	
Utah	Mapleton	5809	E5	490156 - 12/16/80(M)	
Utah	Orem	84324	E5	490216 - 9/24/84(M)	
Utah	Payson	12716	E5	490157 - 1/6/81	
Utah	Pleasant Grove	23468	E5	490235 -	

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS*	THREAT (or NSFHA-eligible)
				(NSFHA)	
Utah	Provo	105166	E5	490159 - 9/30/88	
Utah	Salem	4372	E5	490160 - 7/16/79	
Utah	Santaquin	4834	E5	490250 - **(NSFHA)**	Tributaries 4, 5, & 6
Utah	Saratoga Springs	1003	D4	490227 - **(NSFHA)**	
Utah	Spanish Fork	20246	E5	490241 - 2/19/86(M)	
Utah	Springville	13950	E5	490163 - 2/15/85	
Utah	Vineyard	150	E5	Not Participating	Utah Lake
Utah	Woodland Hills	941	E5	Not Participating	Broad and Snell Hollows

Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.
* D = Detailed Study Report and Map Prepared.

The following table is a vulnerability assessment for a 100 year flood in Utah County

Table U-4

City	County	Population	Households	Value	Employment
Alpine	Utah	2,970	693	$103,950,000	24
American Fork	Utah	1,407	354	$53,100,000	58
Cedar Hills	Utah	0	0	$0	
Genola	Utah	62	17	$2,550,000	
Highland	Utah	1,042	245	$36,750,000	
Lehi	Utah	3,020	821	$123,150,000	166
Lindon	Utah	1,737	398	$59,700,000	338
Mapleton	Utah	469	115	$17,250,000	
Orem	Utah	633	170	$25,500,000	473
Payson	Utah	1,649	441	$66,150,000	191
Pleasant Grove	Utah	173	40	$6,000,000	
Provo	Utah	8,438	2,409	$361,350,000	1388
Salem	Utah	604	186	$27,900,000	7
Saratoga Springs	Utah	451	123	$18,450,000	
Spanish Fork	Utah	1,157	298	$44,700,000	87
Springville	Utah	834	233	$34,950,000	51
Utah	Utah	1,795	492	$73,800,000	
Vineyard	Utah	48	16	$2,400,000	

Table U-5

Roads				
City	County	Type of Road	Length in Miles	Value
	Utah		0.9	$1,800,000
	Utah	Cloverleaf or interchange	0.35	$1,260,000
	Utah	Connecting road	0.08	
	Utah	Jeep trail	0.1	
	Utah	Neighborhood roads	28.71	$57,420,000
	Utah	Primary road	1.25	$2,500,000
	Utah	Secondary road, U.S. highway	1.41	$3,403,035
Alpine	Utah		0.04	
Alpine	Utah	Connecting road, county roads,	0.13	$260,000
Alpine	Utah	Neighborhood roads	2	$4,000,000
American Fork	Utah	Neighborhood roads	0.79	$1,580,000
American Fork	Utah	Primary road, interstate highway	0.11	$396,000
Cedar Hills	Utah	Connecting road, county roads,	0.14	$280,000
Highland	Utah	Connecting road, county roads,	0.26	$520,000
Highland	Utah	Neighborhood roads,	0.82	$1,640,000
Lehi	Utah	Connecting road, county roads	0.56	$1,120,000
Lehi	Utah	Neighborhood roads, city streets	5.04	$10,080,000

Lehi	Utah	Primary road, interstate highway	0.03	$108,000
Lehi	Utah	Secondary road, U.S. highway	0.07	$168,945
Lindon	Utah	Neighborhood roads, city streets	2.37	$4,740,000
Mapleton	Utah	Neighborhood roads, city streets	0.29	$580,000
Orem	Utah	Connecting road, county roads	0.01	$20,000
Orem	Utah	Neighborhood roads, city streets	0.22	$440,000
Orem	Utah	Secondary road, U.S. highway	0.42	$1,013,670
Payson	Utah	Neighborhood roads, city streets	3.16	$6,320,000
Pleasant Grove	Utah	Neighborhood roads, city streets	0.03	$60,000
Provo	Utah	Cloverleaf or interchange	1.16	$4,176,000
Provo	Utah	Connecting road, county roads,	0.07	$140,000
Provo	Utah	Neighborhood roads	5.94	$11,880,000
Provo	Utah	Primary road, interstate highway	0.67	$2,412,000
Provo	Utah	Secondary road	0.02	$40,000
Salem	Utah		0.02	
Salem	Utah	Neighborhood roads	0.72	$1,440,000
Saratoga Springs	Utah	Connecting road, county roads	0.05	$100,000
Saratoga Springs	Utah	Neighborhood	5.58	$11,160,000
Spanish Fork	Utah	Connecting road, county roads	0.36	$720,000
Spanish Fork	Utah	Neighborhood roads	0.49	$980,000
Spanish Fork	Utah	Secondary road, U.S. highway	0.67	$1,617,045
Springville	Utah	Cloverleaf or interchange	0.9	$3,240,000
Springville	Utah	Connecting road, county roads	0.54	$1,080,000
Springville	Utah	Neighborhood roads	1.36	$2,720,000
Springville	Utah	Primary road, interstate	0.61	$2,196,000
Vineyard	Utah	Neighborhood roads	0.9	$1,800,000
		Total	**69.35**	**$145,410,695**

Table U-6

Affected Facilities			
NAME	ADDRESS	CITY	DESC_
Lehi School	765 N Center, Lehi 84043	Lehi	SCHOOL
Sego Lily School	550 E 900 N, Lehi 84043	Lehi	SCHOOL
Lindon City Center	100 N State	Lindon	Government
Payson Fire Department	45 E 100 South	Payson	Fire Station
Parkview School	360 S 100 E, Payson 84651	Payson	SCHOOL
PLEASANT GROVE PD - LINDON STN			police station

Table U-7

Utilities				
City	County	Type of Line	Length in Miles	Value
Alpine	Utah	KV-138	0	$0
American Fork	Utah	KV-46	0	$0
Highland	Utah	KV-138	0	$0
Highland	Utah	KV-46	0	$0
Lehi	Utah	KV-138	1	$48,280
Lehi	Utah	KV-345	1	$48,280
Lehi	Utah	KV-46	0	$0
Lindon	Utah	KV-138	1	$48,280
Lindon	Utah	KV-46	0	$0
Mapleton	Utah	KV-138	0	$0
Orem	Utah	KV-138	0	$0
Orem	Utah	KV-46	0	$0
Provo	Utah	KV-138	0	$0
Provo	Utah	KV-345	1	$48,280
Provo	Utah	KV-46	0	$0
Salem	Utah	Owned by others	0	$0
Saratoga Springs	Utah	KV-46	2	$96,560
Saratoga Springs	Utah	SUB-CO	1	$10,000,000
Spanish Fork	Utah	KV-46	0	$0
Springville	Utah	KV-345	1	$48,280
Springville	Utah	KV-46	0	$0
Vineyard	Utah	KV-345	3	$144,840
	Utah	KV-138	3	$144,840
	Utah	KV-345	14	$675,920
	Utah	KV-46	2	$96,560
	Utah	Owned by others	1	$48,280
	Utah	SUB-CO	0	$0
		Total		$11,448,400

Utah County Flood and Dam failure History

Table U-8

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Utah	May 30, 1939	Thistle	Damage to homes, farmlands, and crops. Highways 50 and 89 received considerable damage	
Flood Utah	July 22, 1943	American Fork	Damage to crops and poultry	
Flood Utah	August 3, 1951	Lehi/Alpine/ American Fork	Damage to homes, farmlands, and crops. Utah Power generator plant damaged as well as 75 feet of	Source Box Elder and American Fork Canyons

			pipeline. Dam in upper American Fork Canyon washed out causing debris flow.	
Flood Utah	August 26, 1952	Lehi	City water lines flooded with mud, National Guard Headquarters flooded	
Flood Utah	July 30, 1953	American Fork	Bridges and roads damaged. Utah Power and Light stations and substations received $10,000 in damage.	Source American Fork Canyon
Flood Utah	September 27, 1962	Provo	Buildings and business establishments in downtown business district flooded	
Flood Utah	May 21, 1973	Payson	Payson Dam washed out causing several hundred thousand dollars in damage to city and roads	
Flood Utah Presidential	Spring 1983	County wide	Damage to county, state, and federal roads, rail lines, homes, and businesses. Damage by municipality below.	Creek Thistle landslide movement Utah Lake elevation reached 4,494.34 causing substantial flooding.
		Alpine	Alpine flooded,	Source Dry Creek Fort Creek
		American Fork	Extensive damage	Source American Fork Canyon
		Covered Bridge Property Owners Association	Bridge washed out forcing use of a swinging footbridge. Without phones for two weeks	
		Elk Ridge	Road damage	Source Loafer Creek
		Genola	Damage to state roads, and public right-of-ways.	
		Goshen	Several thousand dollars in damage.	Culinary water supply contaminated
		Highland	Public park and few road were damaged	Source American Fork Canyon
		Lehi	Damage to roads, bridges, channels, stream banks, and private property	Three families relocated.
		Lindon	Lindon roads damaged	
		Mapleton	$200,000 in damage to all sectors. Five culvert bridges washed out, loss of city culinary water supply.	Source Maple Canyon
		Orem	Minor damage to city other than along Provo River	
		Payson	Damage to water diversion structures in the canyon	Source Payson Canyon
		Pleasant Grove	Damage to streets and homes.	Source Battle Creek Grove Creek
		Provo	Damage to culverts, streets, public property, farmlands, and homes.	Minor landsliding along foothills.

				High groundwater
		Salem	Damage to streets, private yards, and city park	Not eligible for federal funding because damage occurred after the incident period was closed. Sinkholes appeared.
		Santaquin	Damage to roads and loss of culinary water source for six weeks.	
		Spanish Fork	Damage to all sectors	Source Spanish Fork River
		Springville	Damage to riverbanks, bridges, public property, private property, and farmland.	Source Hobble Creek $400,000 in damages
		Strawberry Water Users Association	$216, 777 in damage to improvements owned by the Water Assoc.	Rock diversion dam washed out 2,100 feet of canals, roads, and culverts damaged.
Flooding Utah Presidential	Spring 1984	County Wide	Estate of damage $5, 467,000	

(All dollar values for given are for year of disaster)
Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.

The following table illustrates the vulnerability assessment of the failure of both Deer Creek and Jordanelle Dams. A list of the critical facilities affected by the dam failures is listed in the appendix.

Table U-9

City - Depth of Water	Depth	Population	Households	Value	Employment
Orem – 2	2	36,717	10,683	$1,602,450,000	13983
Provo – 2	2	6,457	1,414	$212,100,000	487
Utah – 2	2	93	28	$4,200,000	
Vineyard - 2	2	36	13	$1,950,000	
Orem – 4	4	3,341	835	$125,250,000	194
Provo – 4	4	6,748	2,011	$301,650,000	386
Spanish Fork - 4	4	0	0	$0	1
Springville - 4	4	119	55	$8,250,000	165
Utah – 4	4	17	5	$750,000	
Orem – 6	6	1,012	252	$37,800,000	600
Provo – 6	6	12,229	3,473	$520,950,000	462
Springville - 6	6	0	0	$0	
Utah – 6	6	70	14	$2,100,000	
Orem – 10	10	272	81	$12,150,000	56
Provo – 10	10	5,123	1,531	$229,650,000	5276
Springville - 10	10	0	0	$0	747
Utah – 10	10	162	44	$6,600,000	
Orem – 15	15	350	92	$13,800,000	5
Provo – 15	15	20,547	6,466	$969,900,000	11343
Springville - 15	15	15	6	$900,000	760
Utah – 15	15	35	7	$1,050,000	
Orem – 20	20	72	14	$2,100,000	4
Provo – 20	20	6,321	1,893	$283,950,000	15737
Vineyard - 20	20	13	4	$600,000	
Orem – 25	25	137	29	$4,350,000	
Provo – 25	25	9,128	2,718	$407,700,000	2953
Orem – 50	50	4	1	$150,000	7
Provo – 50	50	2,253	643	$96,450,000	3851
Total		111,271	32,312	$4,846,800,000	

The following table indicates critical facilities that could be affected by a dam failure: Table U-10

Affected Facilities			
NAME	ADDRESS	CITY	DESC_
Orem Community Hospital	331 N 400 West	Orem	Hospital
Orem City Ambulance Office #2	911 N Main St.	Orem	Ambulance
Orem City Hall	56 N. State	Orem	Government
Orem City Fire Station #2	911 N Main St.	Orem	Fire Station
Cascade School	160 N 800 E, Orem 84057	Orem	SCHOOL
Geneva School	400 N 665 W, Orem 84057	Orem	SCHOOL
Orem School	450 W 400 S, Orem 84058	Orem	SCHOOL
Scera Park School	450 S 400 E, Orem 84058	Orem	SCHOOL
Sharon School	525 N 400 E, Orem 84057	Orem	SCHOOL
Suncrest School	668 W 150 N, Orem 84057	Orem	SCHOOL
Vineyard School	950 W 800 S, Orem 84058	Orem	SCHOOL
Canyon View Junior High	625 E 950 N, Orem 84057	Orem	SCHOOL
Lakeridge Junior High	951 S 400 W, Orem 84058	Orem	SCHOOL
Orem Junior High	765 N 600 W, Orem 84057	Orem	SCHOOL
Mountain View High	665 W Center, Orem 84058	Orem	SCHOOL
Orem High	175 S 400 E, Orem 84057	Orem	SCHOOL
Utah Valley Regional Medical Center	1034 N 500 West	Provo	Hospital
Utah County Offices	100 E Center	Provo	Government
Provo City Hall	351 W Center	Provo	Government
Provo City Electric Energy Department	251 W 800 North	Provo	Government
Provo Ambulance Office #3	601 W Columbia Ln	Provo	Ambulance
Provo Fire Station #4	2050 W 95 South	Provo	Fire Station
Provo City Ambulance Dept Station #4	2050 W 95 South	Provo	Ambulance
Provo Fire Station #3	601 W Columbia Ln	Provo	Fire Station
National Guard Armory	222 W 500 North	Provo	Government
Provo Fire Station #1	80 S 300 West	Provo	Fire Station
Provo City Ambulance Office #1	80 S 300 West	Provo	Ambulance
Valley Ambulance	925 N 500 West	Provo	Ambulance
Amelia Earhart School	2585 W 200 S, Provo 84601	Provo	SCHOOL
Franklin School	350 S 600 W, Provo 84601	Provo	SCHOOL
Sunset View School	525 S 1600 W, Provo 84601	Provo	SCHOOL
Timpanogos School	449 N 500 W, Provo 84601	Provo	SCHOOL
Dixon Middle	750 W 200 N, Provo 84601	Provo	SCHOOL
Farrer Middle	100 N 600 E, Provo 84606	Provo	SCHOOL
Provo High	1125 N University Ave, Provo 8	Provo	SCHOOL
Mt Brook/Eastwood	1300 E Center, Provo 84601	Provo	SCHOOL
Brockbank School	340 W 500 N, Spanish Fork 8466	Spanish Fork	SCHOOL
GENEVA STEEL FIRE DEPT		Vineyard	Fire Station
OREM POLICE DEPT			police station
PROVO POLICE DEPT			police station
UTAH COUNTY SHERIFFS OFC			police station

Utah County Flood Mitigation Goals -

Problem Identification: Flooding occurs primarily from spring snow-melt and occasionally from localized summer thunderstorms. Identifying and then controlling flooding will assist in responding to flood events. Protection of life and property before, during, and after a flooding event is essential.

Goal 1 – Priority High

Objective 1.1 Support the National Flood Insurance Program (NFIP), Flood Map Modernization Program, to update flood risk and flood maps in the County

Action: Support State Floodplain Manager in the Flood Map Modernization Program
Time Frame: Next three years
Funding: Dependent on if cost share is required.
Estimated Cost: Dependent on scope of individual mapping projects.
Staff: City/County Emergency Management, County/City Engineer(s), State Floodplain Manager, Contractors.
Background: The State has designated Utah County as the number one priority community in the State for updated flood maps. County needs to support this designation.

Objective 1.2 Promote flood insurance throughout the County

Action: Create outreach document promoting flood insurance and include in local newspaper(s), libraries, and other public buildings. Especially after wildfires where post fire debris flows are of concern.
Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County Engineer/Floodplain Administrator, County Emergency Management, State Floodplain Manager, DES
Background: General public is usual not aware they can purchase flood insurance even if they are located outside of a Special Flood Hazard Area. This information is especially critical when post fire debris flow potential has been identified and homes are located on alluvial fans.

Objective 1.3 Reduce threat of unstable canals throughout the County. Identify County-wide canal systems

Action: Map and assess for structural integrity canal systems in the County
Time Frame: 3-5 years
Funding: Federal grants
Estimated Cost: Unknown
Staff: County Engineer, County Public Works, County Information and Technology, County Emergency Management
Background: Private and Public canals are used for transportation and dispersion of water as well as flood control.

Objective 1.4 Ensure EOC(s) are equipped to respond to flooding.

Action: Obtain communication equipment that will allow for timely response to flooding.
Time Frame: 1 year
Funding: Federal Grants
Estimated Cost: $30,000
Staff: County Sheriff, County Emergency Management
Background: Support response from alternate EOC. Adequate communication capabilities are essential between all response agencies within the County.

Goal 1 Reduce Risk of Potential Flooding

Unincorporated Utah County

Problem Identification: Utah County is one of the smallest counties in the state terms of size and unincorporated population – with less than 5 percent of its residents live in the unincorporated county. The County does participate in the National Flood Insurance Program and the mapping is scheduled to be updated. No major rivers threaten large unincorporated urban developments. Therefore, no structural flood control projects are warranted at this time. One exception to this is the small development, south of Payson, known as Spring Lake, that is vulnerable to flooding and debris flows. A large debris flood event occurred here in 2002 (following the adjacent Mollie Wildfire in 2001 which made conditions "ripe" for this type of event). Post fire hillside stabilization measures should reduce the flood threat to Spring Lake. General flood threats in the unincorporated county include the Utah Lake tributaries, and other potential flood sources such as Utah Lake itself.

Objective: Minimize future flood damage in the unincorporated County

Action: Nonstructural measures appear to be the most prudent option for the county to implement in the unincorporated areas. Zoning to regulate development of structures near all rivers, creeks, and lakes would be prudent (100 ft minimum setback or greater) as well as limiting development on alluvial fans. New development near canals should be mitigated to limit losses due to canal failures. The county should require developers in these potential hazard areas to submit site specific mitigation plans to minimize potential losses. Costs associated with mitigating the potential hazard should be borne by the developer.

Timeframe:
Funding:
Estimated Cost: Minimal – almost nothing.
Staff:

Cedar Hills

Problem Identification: Cedar Hills is developing rapidly – mostly with large single-family homes. It faces a significant flood threat, especially on the east side of town, from Heisett's Hollow and adjacent, fairly large unnamed drainages to the north and south. Although not currently participating in the NFIP, this community should definitely be considered at rather high risk of flooding and should be included in any Utah County map updates or revisions.

Objective: Minimize future flood damage in Cedar Hills.

Action: A potentially viable alternative would be to construct a detention/debris basin at the mouth of Heisett's Hollow.
Time Frame:
Funding:
Estimated Cost: approximately $1million
Staff:

Action: As with similar communities, the relatively moderate threat of flooding in many parts of the community indicates that nonstructural zoning is preferable to structural measures unless a historic flood problem is known to exist (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Eagle Mountain

Problem Identification: Eagle Mountain is located about 6 miles southwest of Lehi just south of Highway 73. Also one of the state's newer communities, it is growing very rapidly. As of 2003, Eagle Mountain now has a population of about 8,000 residents compared to the 2,000 identified in the 2000 Census. Channel modifications have been made to Tickville Gulch and its tributary West Canyon Wash that flow through the north part of the community. There are also numerous unnamed drainages along the east side of Eagle Mountain that drain Lake Mountain. These drainages range in size from about 1 to 3 square miles and therefore would pose a moderate level of threat during an infrequent flood event.

Objective: Minimize future flood damage in Eagle Mountain.

Action: A potentially viable alternative would be to flood proof those relatively few existing low-lying structures that are subject to flooding near Tickville Gulch and West Canyon Wash.
Time Frame:
Funding:
Estimated Cost: $10k-$30k per structure
Staff:

Action: As with similar, growing communities, the relatively low to moderate threat of flooding to most of the homes indicates that nonstructural zoning is preferable to structural measures unless an historic flood problem is known to exist (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Elk Ridge

Problem Identification: Also a relatively new community, Elk Ridge is situated just southeast of Payson. Elk Ridge is flanked by Loafer Canyon on the east and other unnamed drainages through the rest of the community. Development for the most part, appears to be sited up and away from the channels. However if the channels/culverts were to become blocked by debris or if wildfire were to occur in the surrounding mountain, devastating flood, mud, and debris flows are possible. (A wildfire was experienced in the area during the summer of 2003.)
Objective: Minimize future flood damage in Elk Ridge.

Action: A potentially viable alternative would be to flood proof those relatively few existing low-lying structures that are subject to flooding.
Time Frame:
Funding:
Estimated Cost: $10k-$30k per structure
Staff:

Action: As with similar, growing communities, the moderate threat of flooding indicates zoning would be less costly than structural measures (unless an historic flood problem is known to exist -see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Goshen

Problem Identification: Although not participating, this community appears to have little flood threat - unless Goshen Reservoir has problems in the future (earthquake or slope stability issues).

Objective: Minimize future flood damage in Goshen.

Action: As with similar small communities, the relatively low threat of flooding indicates that nonstructural zoning is preferable to structural measures unless a historic flood problem is known to exist (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Santaquin

Problem Identification: Although Santaquin has a NSFHA designation based on its old town boundaries, it clearly has a very high flood, mud, and debris flow threat in the newer part of town – east of Interstate 15 – that needs to be addressed. It appears that virtually all development east of I-15 is at risk due to its location right on top of major alluvial fans. They are known as Tributaries 4, 5, and 6 (north to south). Although development for the most part, appears to be sited up and away from the channels, during the 2002 debris flow event (preceded by the 2001 Mollie Wildfire), the channels became blocked by debris and a devastating flood, with mud and debris flows occurred – putting the lives of many in community at very high risk. (Amazingly no one was injured or killed in the disaster.) Debris flow boundaries delineated by the Utah Geological Survey (attached) should be used as a minimum to approximate the flood threat until detailed analyses can be made.

Objective: Minimize future flood damage in Santaquin.

Action: Detention/debris basins are urgently needed if the town is going to continue to allow development "in harms way".

Timeframe:
Funding:
Estimated Cost: Approximately $500k - $1 million each – Total $2.5 million
Staff:

Action: As with similar growing communities, nonstructural zoning is less costly than structural measures to prevent future damages (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Saratoga Springs

Problem Identification: Like Santaquin, this community has also grown very rapidly and is also designated as a NSFHA. It appears to face a moderate flood threat from Tickville Gulch on the north and at least a dozen other drainages along the east side of town (in addition to the threat from Utah Lake).
Objective: Minimize future flood damage in Saratoga Springs.

Action: A potentially viable alternative would be to flood proof those relatively few existing low-lying structures that are subject to flooding.
Time Frame:
Funding:
Estimated Cost: $10k-$30k per structure
Staff:

Action: As with similar, growing communities, the low to moderate threat of flooding indicates that nonstructural zoning is preferable to structural measures unless an historic flood problem is known to exist (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Vineyard

Problem Identification: Although there is no flood threat from any rivers, creeks, or streams, Utah Lake is within the corporate boundary-leaving Vineyard at some risk. A 1997 COE reconnaissance study (Provo River and Tributaries) determined that the 100-yr elevation of Utah Lake would be approximately 4494.5 MSL. Most of Vineyard is well above this elevation so the relative risk is minimal.

Objective: Minimize future flood damage in Vineyard

Action: As with similar communities, the relatively low threat of flooding indicates that nonstructural zoning is preferable to structural measures unless an historic flood problem is known to exist (see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Woodland Hills

Problem Identification: Also a relatively new community, Woodland Hills is situated southeast of Payson, in the southeast corner of Utah County. Woodland Hills is flanked by Maple Canyon on the east and is threatened by Broad and Snell Hollows, as well as another unnamed drainage through the rest of the community. Development for the most part, appears to be sited up and away from the channels. However if the channels/culverts were to become blocked by debris or if wildfire were to occur in the surrounding mountain, devastating flood, mud, and debris flows are possible – putting the community at very high risk.

Objective: Minimize future flood damage in Woodland Hills.

Action: A potentially viable alternative would be to flood proof those relatively few existing low-lying structures that are subject to flooding.
Time Frame:
Funding:
Estimated Cost: $10k-$30k per structure
Staff:

Action: As with similar, growing communities, the moderate threat of flooding indicates that nonstructural zoning would be preferable to structural measures (and less costly - unless an historic flood problem is known to exist - see discussion on zoning in the County's mitigation section above).

Timeframe:
Funding:
Estimated Cost: Minimal.
Staff:

Dam Failure Mitigation Goals

Problem: National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for 34% of all dam failures. Foundation defects, including settlement and slope instability, account for 30% of all failures. Piping and seepage cause 20% of national dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The remaining 16% of failures are caused by other means. Deer Creek and Jordanelle Dams are of specific concern in the County.

Goal 1 – Priority Medium

Objective 1.1 Obtain most up to date and accurate information on dams in County to protect lives and property from dam failure.

Action 1: Include dam inundation maps in current County EOP.
Time Frame: 3-5 Years
Funding: Undetermined
Estimated Cost: $ 10,000.00
Staff: County Emergency Management, BOR and State Dam Safety
Background: Maps are not current and need to reflect impact on new residential and commercial properties. Utah Division of Water Rights Dam Safety Section is currently reviewing the maps as well as digitizing them. Digitized dam failure inundation maps will aid Utah County in future emergency management planning.

Objective. 1.2 Early warning systems (sirens) are critical to protecting lives from Jordanelle/Deer Creek dam failure.

Action 2: Continue to test warning sirens along Provo River
Time Frame: Ongoing
Funding: BOR and County, Provo and Orem City
Estimated Cost: Unknown

Staff: County/City Emergency Management and Public Works, UDOT, BOR, Sheriff and local Police.
Background: Current siren system needs to be tested on a regular basis and allow local responders to participate in the testing. This will create better planning and awareness at the local level.

Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of additional measures that could be used to limit the exposure to flood related damage.

Prevention

- Planning and Zoning
- Floodplain open space preservation
- Building construction regulation
- Regulation of other facilities (critical)
- Stormwater management

Property Protection

- Relocation
- Acquisition
- Building elevation
- Flood proofing
- Lifeline protection
- Flood Insurance

Natural Resource Protection

- Wetlands protection
- Erosion and sediment control

Emergency Services

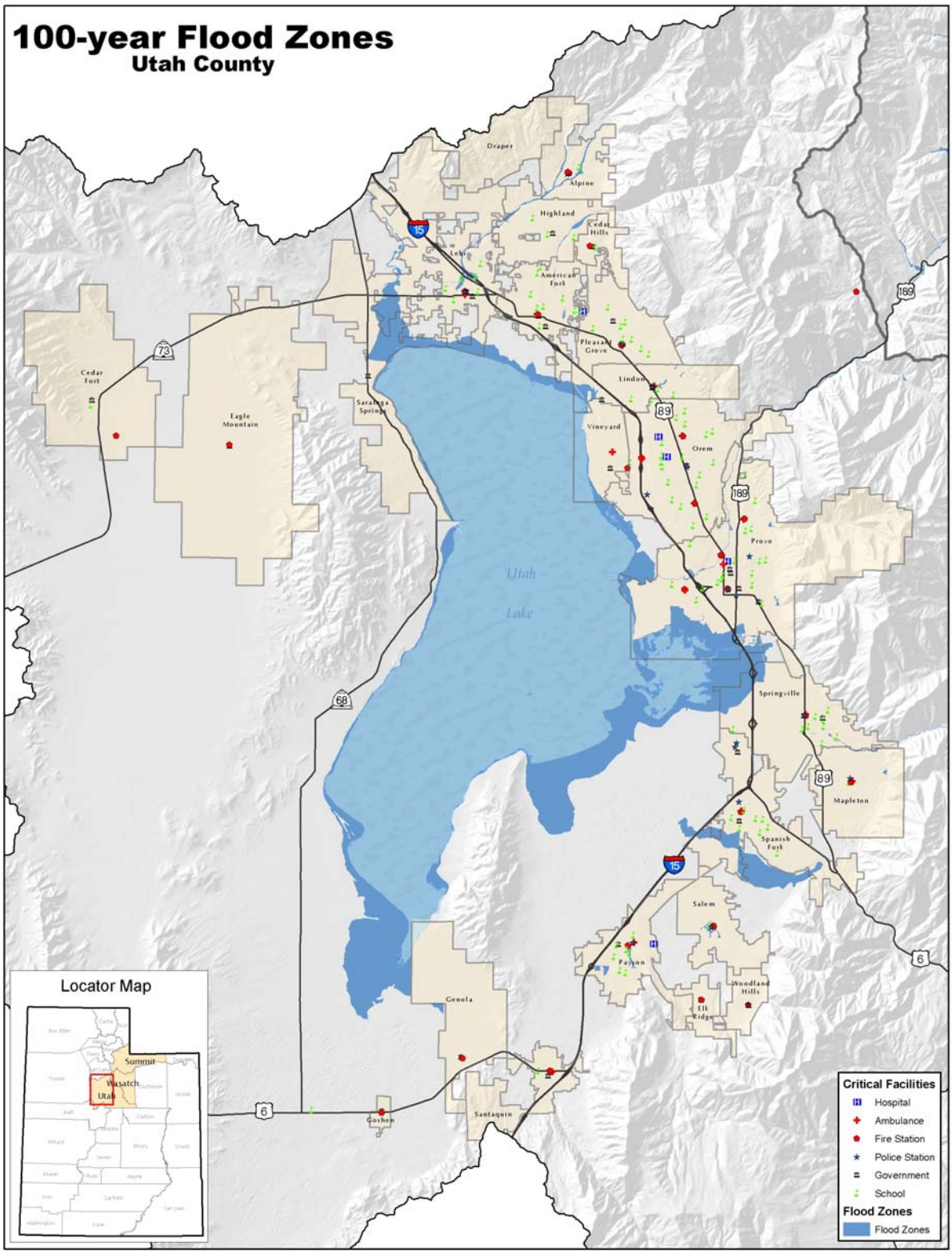
- Flood threat recognition
- Warning dissemination
- Flood response
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

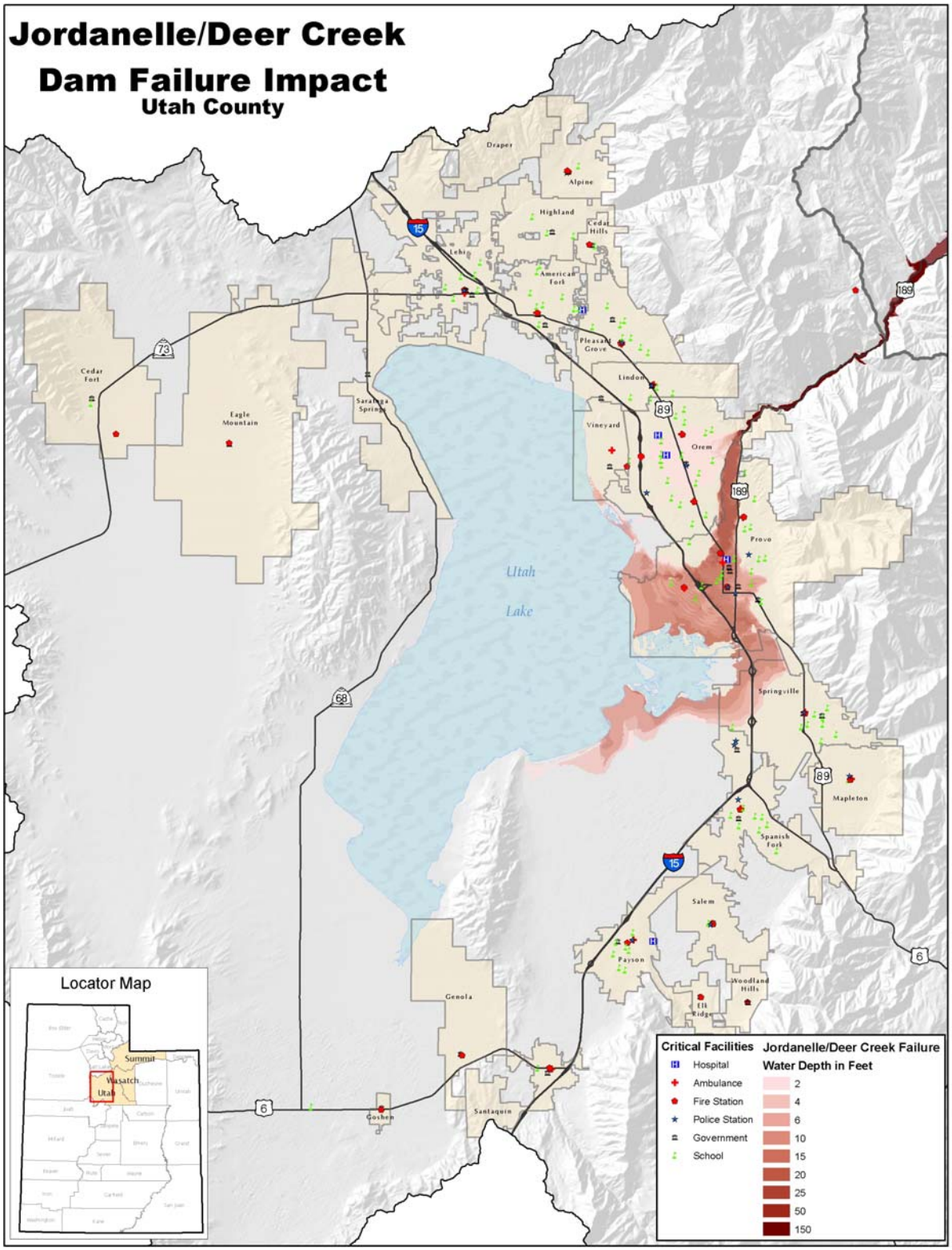
Structural Projects

- Reservoirs/impounds
- Levees
- Diversions
- Channel and drainage modifications
- Channel and basin maintenance

Public information

- Flood Hazard maps
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Environmental education


100-year Flood Zones
Utah County
Draper
Alpine
Highland
Cedar Hills
Lehi
American Fork
Pleasant Grove
Lindon
Vineyard
Orem
Provo
Springville
Mapleton
Spanish Fork
Salem
Payson
Woodland Hills
Elk Ridge
Genola
Santaquin
Goshen
Cedar Fort
Eagle Mountain
Saratoga Springs
Utah Lake
15
89
189
73
68
6
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Flood Zones
Flood Zones


Jordanelle/Deer Creek
Dam Failure Impact
Utah County
Draper
Alpine
Highland
Cedar Hills
Lehi
American Fork
Pleasant Grove
Lindon
Vineyard
Orem
Provo
Springville
Mapleton
Spanish Fork
Salem
Payson
Woodland Hills
Elk Ridge
Genola
Santaquin
Goshen
Cedar Fort
Eagle Mountain
Saratoga Springs
Utah
Lake
15
73
89
189
68
6
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Jordanelle/Deer Creek Failure
Water Depth in Feet
2
4
6
10
15
20
25
50
150

Wildland Fire

Assessing Vulnerability

The following table illustrates the vulnerability assessment for wildfire in Utah County.

Table U-11

NAME	County	Population	Households	Value	Employment
Alpine	Utah	3,284	735	$110,250,000	141
Cedar Fort	Utah	65	17	$2,550,000	0
Cedar Hills	Utah	99	26	$3,900,000	0
Draper	Utah	139	36	$5,400,000	0
Eagle Mountain	Utah	14	3	$450,000	0
Elk Ridge	Utah	1,027	234	$35,100,000	0
Goshen	Utah	109	30	$4,500,000	0
Lehi	Utah	4	1	$150,000	0
Lindon	Utah	2,631	573	$85,950,000	209
Mapleton	Utah	256	57	$8,550,000	122
Orem	Utah	1,415	281	$42,150,000	1
Payson	Utah	830	227	$34,050,000	26
Pleasant Grove	Utah	850	192	$28,800,000	71
Provo	Utah	4,487	1,171	$175,650,000	4996
Santaquin	Utah	892	233	$34,950,000	115
Spanish Fork	Utah	855	217	$32,550,000	131
Springville	Utah	2,301	582	$87,300,000	197
Utah	Utah	2,360	649	$97,350,000	1
Woodland Hills	Utah	112	28	$4,200,000	0

The following table is a historical list of fires over 100 acres in Utah County.

Table U-12

FIRE_ID	YEAR	NAME	SDATE	CAUSE	COUNTY	TYPE	SIZE
3141-2000	2000	GENOLA CITY	8/10/2000	MC	Utah	Rural	120.00
2999-2000	2000	NEBO CREEK	8/1/2000	LT	Utah	Wildland	120.00
2073-1999	1999	CLAY PIT 2	8/29/1999	MC	Utah	Wildland	400.00
2065-1999	1999	JENSEN	11/6/1999	DB	Utah	Wildland	475.00
3905-2001	2001	MILE MARKER 12	7/2/2001	LT	Utah	Wildland	655.00
2072-1999	1999	LONG RIDGE	7/24/1999	CF	Utah	Wildland	1049.00
3043-2000	2000	DIVIDEND	7/4/2000	LT	Utah	Wildland	1154.00
3001-2000	2000	BISMARK	7/26/2000	LT	Utah	Wildland	2930.00
2075-1999	1999	CEDAR VALLEY	6/25/1999	MC	Utah	Wildland	3200.00
2074-1999	1999	CLAY PIT	8/14/1999	MC	Utah	Interfac	4407.00

3000-2000	2000	TEN MILE	8/6/2000	IN	Utah	Wildland	5500.00
4409-2001	2001	MOLLIE	8/18/2001	IN	Utah	Interfac	8021.00

Overview

Wildfires occur on a regular basis in Utah County. Most fires occur in the late summer to early fall. Although many fires occur from natural causes such as lightning, humans cause most fires. Sparks from trains traveling on the railroad cause many small fires in south Utah County. People riding ATV's, using fireworks and campfires also start a number of fires in the area.

Development Trends

As development occurs on the bench areas of Utah Valley more homes will be in danger of wildfire. Communities need to make developers and homeowners aware of the danger. Cities should also require firebreaks and access roads along urban/wildland interfaces. Although development brings homes closer to areas of potential wildfire, it also brings water and access for firefighters closer to the urban fringe. Firewise community development principles, such as not storing firewood near homes, installing fire resistant roofing and cleaning debris from rain gutters will reduce potential loses.

Mitigation Strategies–Wildland Fire

Problem Identification: Non-compliance with Firewise development practices.

Goal 1 – Priority High

Objective 1.1 Increase and ensure compliance with existing building and fire codes, especially in the rural areas of the County where secondary residences are upgraded or new construction.

Action 1: Develop and enforce current local, state and national codes
Time Frame: Ongoing
Funding: Local, state and federal grants
Estimated Cost: Unknown
Staff: Local, state and federal agencies
Background: Implement and enforce rules, regulations and codes

Problem Identification: Building continues to be of concern in Urban Wildfire Interface Areas (URWIN). Especially in the following areas: Identified high hazard areas along foothills adjacent to Wasatch Front, eastern Utah County adjacent to Highway 6 to include Solider Summit, and areas along Highway 89 South into Sanpete County

Goal 2 – Priority High

Objective 1.1 Educate homeowners on how to reduce risk of wildfire damage

Action 1 : Conduct an education program (Firewise) on reducing wildfire risks
Time Frame: Ongoing
Funding: County
Estimated Cost: Minimal
Staff: Fire District(s), County Emergency Management, State FFSL

Background: Educate homeowners using newsletters and personal contacts of the importance of clearing combustibles from perimeters of their homes. Currently, Sundance is the only recognized Firewise Community in the County.

Action 2: Work with State Forestry Fire and State Lands and US Forest Service to identify areas where fire breaks and be designed, implemented and maintained.
Time Frame: 3 years
Funding: County, State and Federal
Estimated Cost: Unknown
Staff: Private land owners, County Public Works, County Emergency Management, Fire District, State Forestry Fire and State Lands, US Forest Service
Background: Wildfires have the potential to threaten high density population communities along the Wasatch Front.

Action 3: Using Sundance as a model Firewise community, promote the Firewise Program in the County.

Time Frame: Ongoing
Funding: County, State and Federal Grants
Estimated Cost: Minimal
Staff: County Emergency Management, State FFSL, US Forest Service

Background: It is essential to continue to promote wildfire mitigation actions and educate homeowners on wildfire risks.

The following mitigation strategies are provided so that communities may be aware of additional measures that could be used to limit the exposure to Wildland Fire related damage.

Prevention

- Zoning ordinances to reflect fire risk zones
- Regulate development areas near fire protection and water resources
- Planning to include: spacing of buildings, firebreaks, on-site water storage, wide roads, multiple access
- Code standards for roof materials and fire protection systems
- Maintenance programs to clear dead and dry brush
- Regulations on open fires
- Open space around structures

Property Protection

- Retrofitting roofs, add spark arrestors
- Create and maintain defensible space
- Insurance
- Eliminate ladder fuels
- Install sprinkler systems
- Develop fire resistant plans
- Have home addresses clearly displayed
- Clean out rain gutters

Natural Resource Protection

- Require mitigation of development in high-risk areas
- Understand impact of non-native vegetation
- Promote tread soft ATV use
- Develop watershed management plans
- Maintain watersheds
- Establish and promote fuel reduction

Emergency Services

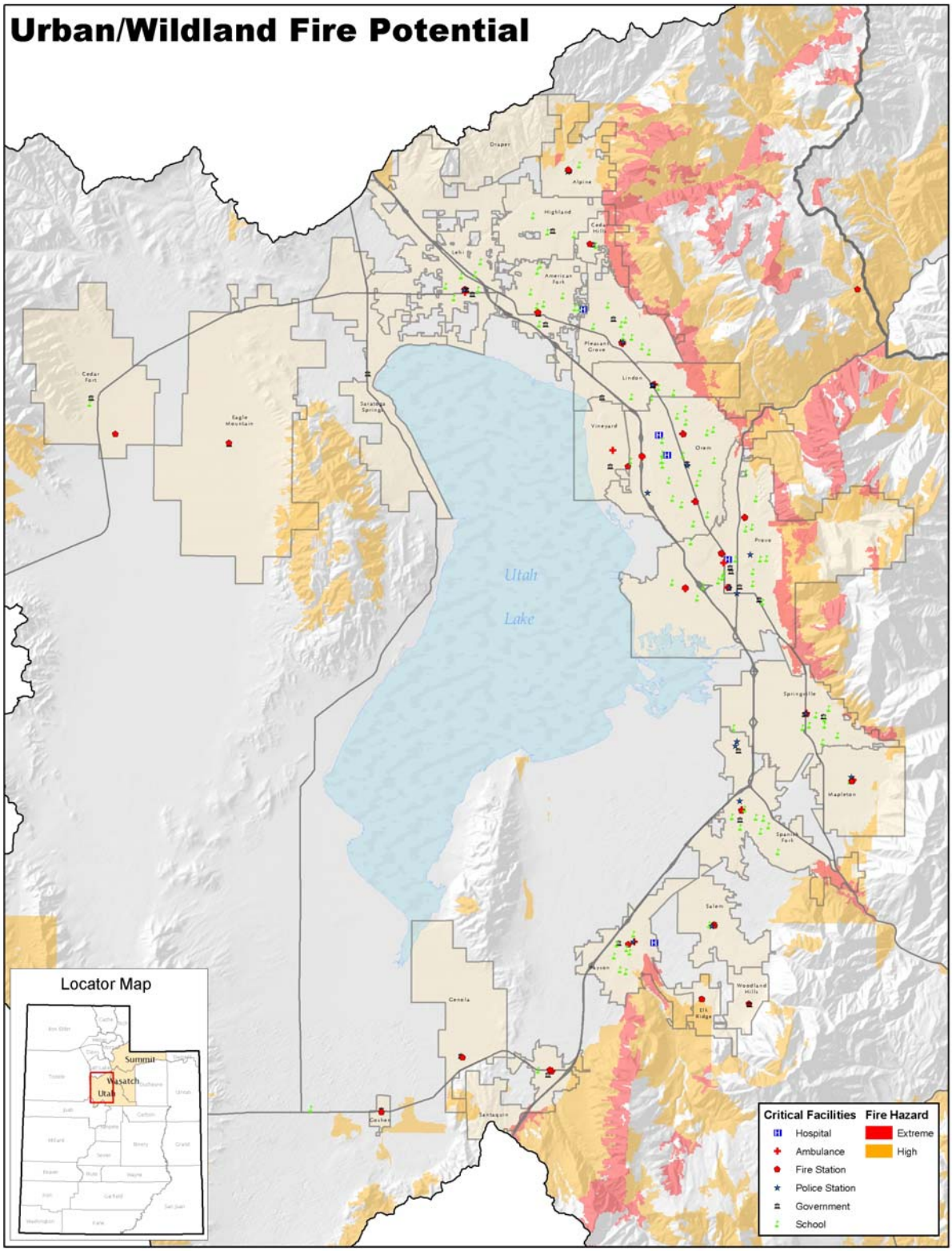
- Mutual aid agreement for fire fighting
- Participate in State Wildfire Suppression Fund
- Develop and exercise local wildfire response plan and evacuation plans

Structural Projects

- Construct wildfire fuel breaks
- Install Heliport water stations
- Tree and underbrush thinning in critical areas
- Increase the number of fire hydrants
- Install water tanks

Public information

- Develop maps for wildfire hazard areas
- Mail wildfire information to owners high-risk structures
- Develop urban wildfire “How to protect your home from Wildfires” book
- Publish newspaper articles on wildfires
- Presentations on wildfires at community meetings
- Develop displays for public buildings and events
- Real estate disclosure of high hazard wildland fire area


Urban/Wildland Fire Potential
Utah
Lake
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Fire Hazard
Extreme
High

Landslide/Problem Soils

Assessing Vulnerability

Due to the topography of Utah County, landslides are an issue. The foothills and alluvial fans on the bench areas are desirable for home locations. Landslides and debris flows often occur after a wildfire event. The following table illustrates the vulnerability assessment for landslides in Utah County.

Table U-13

Name	Households	Value	Population	Employment
Alpine	604	$90,600,000	2,617	2
American Fork	17	$2,550,000	71	
Cedar Hills	156	$23,400,000	705	
Draper	36	$5,400,000	139	
Elk Ridge	202	$30,300,000	871	
Genola	91	$13,650,000	394	
Highland	74	$11,100,000	301	
Lehi	360	$54,000,000	1,408	
Lindon	768	$115,200,000	3,500	160
Mapleton	74	$11,100,000	322	6
Orem	970	$145,500,000	4,020	536
Payson	169	$25,350,000	613	24
Pleasant Grove	1,629	$244,350,000	6,900	103
Provo	3,854	$578,100,000	13,320	5106
Salem	281	$42,150,000	1,147	182
Santaquin	59	$8,850,000	208	78
Spanish Fork	503	$75,450,000	2,101	6
Springville	993	$148,950,000	3,813	180
Utah	704	$105,600,000	2,737	
Vineyard	1	$150,000	1	
Woodland Hills	208	$31,200,000	885	
Total	11,753	$1,762,950,000	46,073	

Data source: Utah County Public Works

Table U-14

Affected Facilities			
NAME	ADDRESS	CITY	DESC_
Canyon Crest School	4664 N Canyon Rd	Provo	School
Woodland Hills Fire Department	Woodland Hills Dr	Woodland Hills	Fire Station
Woodland Hills City Offices	125 E Lakeview Wy	Woodland Hills	Government

Problem soils are also an issue in the county. Most of the problem soils deal with expansive and collapsible soils. Damage is usually caused by homeowners directing either sprinklers or gutter down pipes toward the foundations of homes or water main breaks. Cities should require site-specific soils reports when the community approves subdivisions.

Thistle Slide

In 1983 the town of Thistle, Utah, known to many highway travelers as the small community where both the Spanish Fork River and nearby U.S. highways branch, was eliminated by the most costly landslide on record in the United States.

Thistle was located at the triple junction of transportation systems leading south to Sanpete County, east to the coal counties of Carbon and Emery and points beyond, and northwest to the Wasatch Front and Salt Lake City. Two major highways converged at Thistle (U.S. Highways 89 and 6). Until the landslide, two rail lines also converged at Thistle--the main line of the Denver and Rio Grande Western Railroad (D&RGW) joining Denver and Salt Lake City, and a branch line to Marysvale.

Ironically, the main line of the D&RGW railway from Denver to Salt Lake City follows the Soldier Creek and Spanish Fork drainages because of, rather than in spite of, landslides. Few corridors through the Rocky Mountains accommodate the gentle gradients required by railroads. Less stable landforms susceptible to landslides have eroded and formed the gentler terrain that allows modern rail passage. The advantages of this route had long been known. Undoubtedly the local Native Americans who guided the Spanish explorers traveled this route. Later trappers and pioneers used this natural corridor for their trade and transportation needs. The name "Spanish Fork" refers to the early exploration of the area by the Spanish, specifically Dominguez and Escalante in 1776 as they sought a trading route from Mexico to California. Soldier Creek is named for the route taken by federal troops as they moved through the area in the mid-1800s.

Storms heralding the 1982 to 1986 wet cycle kicked off the wettest month ever recorded at the Salt Lake City International Airport in September 1982, and saturated the ground before the winter snows. The winter was neither exceptionally wet nor cold. However, snows and cold nights continued late into April and May 1983, and resulted in an unusually late and sudden snowmelt when temperatures did warm up. May snowpacks of northern Utah averaged two to three times their normal. Utah's landslide problems correlate with precipitation and snowmelt. Two large landslides in the early spring alerted geologic experts to the situation. The National Weather Service briefed local and national officials about the unusual conditions. Yet even with the geologic and climatic indicators, the events of April, May, and June caught the state by surprise.

Starting in January, the D&RGW watched the Thistle area as well as several other landslide-prone areas near Soldier Summit. Their geotechnical experts visited the area on April 12. Days later, when the Thistle landslide began to move visibly, no one recognized it as a major hazard. The railroad tracks went out of alignment on Wednesday, 13 April. The highway became bumpy, fractured, and became impassible on Friday, 15 April. The streambed and deposits on the canyon floor rose approximately one foot an hour as a huge tongue of earth piled up against the bedrock buttress of Billies Mountain, filled the canyon, and dammed the river. The waters of the Spanish Fork River rapidly created Thistle Lake upstream of the landslide dam.

The railroad company and the Utah Department of Transportation (UDOT) initially tried to keep the railroad tracks, highway, and river open. Sunday, 17 April the landslide defeated efforts to cut down through the rising toe of the landslide and allow passage of the river water. Efforts to siphon waters rising behind the landslide dam also failed. Rising lake waters drowned the community of Thistle. That very day, the president of the D&RGW announced at Thistle that the railroad would tunnel a new railroad course through Billies Mountain. To be successful, the tunnel had to be above Thistle Lake's eventual highest water line. Railroad experts in consultation with the state decided to form the landslide into a dam and to construct an overflow spillway tunnel to control the uppermost rise of the lake. Having calculated

how fast an overflow tunnel could be constructed, and how fast the lake would rise, they began drilling. The state took charge of public safety priorities. Armies of workers and heavy equipment shaped the landslide dam while it moved by transferring 500,000 cubic yards of earth from the middle area of the landslide onto its toe. This also provided a platform from which to construct the tunnels. The state constructed a third tunnel to drain the impounded water. UDOT decided to relocate the highway over Billies Mountain. The Army Corps of Engineers constructed a pumping system to keep Thistle Lake from rising to dangerously high levels.

The impounded water rose at approximately the rate predicted and the D&RGW contractors completed the overflow tunnel system with two days to spare. Trains passed through the new tunnel on 4 July, eighty-one days after the initiation of the project and eleven days before the contracted completion date. The new tunnel provided a permanent bypass for the Spanish Fork River around the landslide. The relocated highway encountered difficult geotechnical problems. The highway opened at the end of the year but was often closed due to major rockfalls and slope stability problems.

The town of Thistle was destroyed. The Marysvale branch line of the railroad was never reopened, leaving a large area of central Utah without rail service. Thistle resulted in Utah's first presidential disaster declaration and became the most costly landslide the United States had experienced. The Utah Business and Economic and Research Bureau reported the following dramatic impacts of the landslide. The D&RGW and Utah Railway embargoed all shipment that normally went through Thistle. The rerouting surcharge of $10 per ton virtually stopped coal shipments. Two trucking companies laid off workers, cancelled contracts, and even suspended operations. Most of the area's coal mines laid off miners, cancelled contracts, and experienced shut downs. Some miners' commutes suddenly exceeded 100 miles. Some coal haulage commutes trebled. Due to market conditions and the Thistle landslide, coal production dropped nearly 30 percent in 1983. Uranium producers paid substantially more for supplies in an already soft market. At least one oil company became non-competitive due to increased travel costs. Tourism in the area, particularly in-state tourism, sagged in response to negative publicity and difficult access. To the south, the blockage of route 89 and the Marysvale line hurt coal companies, turkey and feed operations, and gypsum, cement, and clay shipments.

The Thistle landslide caused total estimated capital losses of $48 million and revenue losses of $87 million, plus associated losses in tax revenues. Direct costs of Thistle tally over $200 million, including relocating the railroad at a cost of $45 million, relocating the highway at a cost of $75 million, and lost revenue to the railroad of $1 million per day (which totaled $80 million, including $19 million in charges that the D&RGW paid the Union Pacific to use their rail lines).
See: O.B. Sumsion, Thistle . . . Focus on Disaster (1983).

Santaquin Mollie Fire Debris Flow

In August of 2001, the 8,000+ acre Mollie Fire burned Dry Mountain above Santaquin. The bench development area of Santaquin City is located not more than 50 yards from the edge of the fire perimeter. This enormous wild fire left a devastated hillside, and the city below, vulnerable to the slipping of loosened earth with the onset of late summer monsoon rains.

At approximately 6:45 p.m. on Thursday, September 12, 2002, after nearly a week of steady rain, the charred earth of the ironically named Dry Mountain gave way and mud flowed out of five separate canyons. Of the five flows, two caused extensive property damage, one to residents of Santaquin and one to the residents of unincorporated Spring Lake. Furthermore, one flow of nearly equal volume flowed through a principally undeveloped area of Santaquin. According to USGS statistics, the highest possibility of ground slippage will occur within the first year after the fire. Although chronologically the mudslide occurred more than 365 days from the wild fire, it was still in the first monsoon season following the fire.

Following the fire, Santaquin City and the US Forest Service participated in a massive re-seeding effort on the mountain in an attempt to prevent or minimize the potential for a mudslide. Furthermore, the City took steps to prevent the potential mudslide from impacting the citizens of the community. Jersey barriers were placed along the upper boundaries of the developed community. In addition, walls of straw bails were constructed in areas analyzed to be the highest possibility of water flows. Both the City and the Forest Service, with the help of the National Weather Service, maintain constant monitoring of the mountainside.

Over the course of the 12+ months that followed the Mollie fire, the City collaborate with numerous governmental divisions, private firms and private property owners to develop and design a plan to handle whatever may come out of the canyons. Even before the mudslide event, the City initiated efforts to record easements for the construction of debris flow channels. Although they found it hard skating, the mudslide event showed that the efforts of the parties involved was in fact necessary.

In the time since September 2002, a formal diversion channel has been constructed to lead any further debris that comes out of the canyons into a natural ravine. Within the ravine, silt fencing and flow breaks have been installed to slow the flow of debris in the ravine and thereby minimizing its potential impact. This ravine travels between developed areas and down the hill to the location of US highway 198. Here UDOT has approved and is constructing culverts under the highway that will allow the debris pass under the highway and be disposed of without endangering private property.

The developed area within Santaquin City, which was hardest hit by the mudslide is as yet to be protected from future slide events. Due to the unwillingness of private property owners, no effort other than re-seeding the mountainside, have taken place to protect those residences.

Recommendations related to the Mollie Flow

- Coordinate with the Uinta National Forest Burned Area Emergency Rehabilitation (BAER) Team on post-wildfire watershed improvements.
- Consult with the USDA's Natural Resources Conservation Service (NRCS) concerning eligibility for the Emergency Watershed Protection (EWP) program.
- Note: This program is still available to the City of Santaquin.

- Promote purchasing of flood insurance through the National Flood Insurance Program (NFIP) for those individuals building or purchasing homes on alluvial fans.
- Construction of detention basins, deflectors, or other engineered structures.
- Note: Detention basins at the mouths of canyons catch all incoming debris flows, thus there is less chance for failure.
- Note: Possible funding mechanisms include special projects fees as part of a storm water collection fee, for homeowners living on alluvial fans.
- Adopt and enforce ordinances requiring geotechnical reports addressing debris flow, flooding, earthquakes, rock falls, and landslides for all proposed developments in areas susceptible to natural hazards. Maps illustrating the location of most of the above mentioned natural hazards are available through Utah County.
- Note: Utah Geological Survey (UGS) provides no cost independent review and recommendations of geotechnical reports to determine their accuracy and completeness. In addition, the Division of Emergency Services and UGS will aid in the design and implementation of ordinances concerning natural hazards.
- Register any structure pertaining to water impoundment with Division of Water Rights, Dam Safety Section.
- Note: The retention basin located within the impacted subdivision was not registered with Dam Safety.

Buckley Draw—Springville Fire

The Springville fire started on June 30, 2002 at 7:19 p.m. The fire burned a total of 2,207 acres above dozens of homes. The immediate post fire impacts for Provo City were: loose surface rock, silty and sandy soils, and blackened steep (40% grade) hillsides. Steep terrain and impervious soils cause rapid run off with rocks. Post fire conditions increased sediment expectations to 13 tons per acre. Brian McInerney of the NWS stated our risk level was the highest in the state.

Recommendations for mitigation offered to Provo City included the Uinta National Forest rehabilitating the burn area with vegetation (seed and mulch) and installing wire fences in the upper channel. The Natural Resource Conservation Service (NRCS) and the Emergency Watershed Program (EWP) implemented temporary measures to reduce the transport of sediment. Additionally, a Rain Activated Weather Station (RAWS) unit was relocated to the Buckley Draw area (elevation of 9,143 feet) to monitor site conditions on Sunday, July 13, 2002.

Provo City held public meetings on Sunday, July 13, and Monday, July 14, 2002 to present information and resources for the residents. National Flood Insurance Program (NFIP) information distributed. Sandbags and sand drops were scheduled and delivered.

On July 15, 2002, information was distributed to the Neighborhood regarding the increase in risk of post fire debris flow, with information about the NFIP program. Communication links to relay current hazard information to the residents were established. The evacuation plan was updated.

On July 16, 2002 a helicopter overview of the burn area was taken. Provo Public Safety responders had a Post Fire Debris Flow Risks in Utah class on July 31, 2002. NRCS and the EWP engineered of a trench to redirect potential debris flow. Provo City obtained the necessary property agreements. Two debris flow events just to the north and just to the south of Provo in September, 2002 provided motivation to secure agreements and build the trench.

A SNOTEL was installed above the Little Rock Canyon drainage to monitor soil moisture and snow pack conditions on 22 October, 2002.

At the April 29, 2003 neighborhood meeting, the debris flow in Santaquin was contrasted with the conditions at the Buckley Draw. Plans for trench construction were discussed. A flag notification system and evacuation plan for the residents for the risk level was proposed and accepted. A web link with updated hazard information, a phone 'hot line' with an updated message, and a notification procedure alerting the Neighborhood Chair of any changes in the hazard level were implemented. A practice evacuation drill was held on Saturday, May 10, 2003.

The 1500 feet long trench was essentially complete on July 28, 2003. Weather conditions continued to be monitored on a daily basis.

At approximately 3:00 a.m. on September 10, 2003, four separate debris flows were triggered. The second largest flow came down the newly finished trench. There was little or no warning. This flow would have been life threatening and would have caused significant property damage without the debris trench in place. The spreader fences in the debris field distributed the runoff materials and completely contained this debris flow.

Development Trends

Development along the foothills and bench areas is very desirable as more development occurs, more homes will be at risk for landslide damage. As more of the county land is developed, more marginal areas with problems soils will be developed.

Mitigation Strategies

The following mitigation strategies are provided so communities may be aware of additional methods that could be used to limit the exposure to Landslide/Problem Soils related damage.

Prevention

- Planning and zoning restrictions and regulations
- Open Space
- Building Codes
- Drainage system maintenance
- Monitor and evaluate areas after wildfire
- Install ground monitoring instruments on landslide-prone areas
- Establish codes (grading, construction, excavation) in landslide prone areas

Property Protection

- Insurance
- Remove soil
- Ensure rain gutters and sprinklers are directed away from structures
- Control and monitor surface and ground water drainage
- Control building in areas of landslides
- Evaluate property maintenance in areas of landslides (over watering)

- Plan proper valving of waterlines to ensure quick turn off in the event of a waterline break

Natural Resource Protection

- Leave area as open space
- Identify structures impacted by problem soils
- Complete a watershed management plan
- Limit use of ATVs in areas off landslides to manage erosion
- Evaluate impact of wildfire in areas of landslides
- Mitigate development in landslide-prone areas
- Maintain natural vegetation

Emergency Services

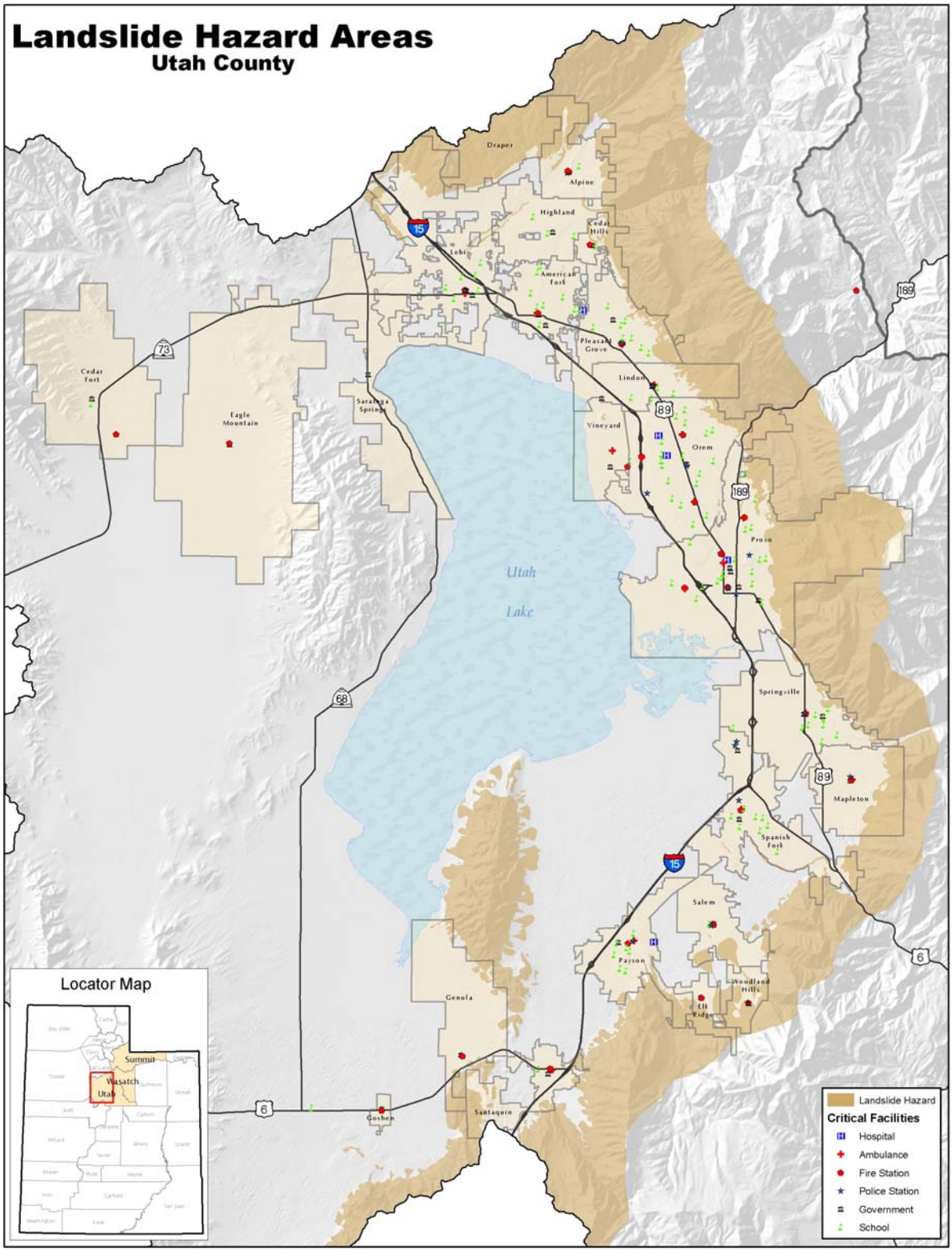
- Identify structures impacted by problem soils
- Monitor and warning systems
- Evacuation plans and exercises
- Critical Facilities Protection
- Equip emergency crews with water valve shut-off keys

Structural Projects

- Pre-soak and/or compact soils
- Install drain fields
- Bring in structural fill
- Build buttress, retaining walls and other engineered structures
- Install subsurface drainage materials
- Remove potential landslide debris

Public information

- Develop information on problem soils
- Outreach information on problem soil mitigation
- Map soils and landslide areas
- Real estate disclosure
- Notice to homeowners in landslide areas detailing hazard
- Library
- Technical Assistance
- Education


Landslide Hazard Areas
Utah County
Draper
Alpine
Highland
Cedar Hills
Lehi
American Fork
Pleasant Grove
Lindon
Vineyard
Orem
Provo
Springville
Mapleton
Spanish Fork
Salem
Payson
Woodland Hills
Elk Ridge
Genola
Santaquin
Goshen
Cedar Fort
Eagle Mountain
Saratoga Springs
Utah
Lake
15
73
68
89
189
6
Locator Map
Summit
Wasatch
Utah
Landslide Hazard
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School

Earthquake/Liquefaction

Please see the HAZUS-MH Earthquake event report for Utah County 2500 year event, print date October 20, 2003 in the appendix of this document for full details of vulnerability. According to the HAZUS-MH run, about 63% or 51,171 buildings will be damaged and that 6,812 buildings will be completely destroyed. Liquefaction has a greater potential for damage than the earthquake itself in Utah County.

The geographical size of the region is 2,138.07 square miles and contains 85 census tracts. There are over 99 thousand households in the region and has a total population of 368,536 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 81 thousand buildings in the region with a total building replacement value (excluding contents) of 16,313 (millions of dollars). Approximately 99.00 % of the buildings (and 83.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,997 and 846 (millions of dollars), respectively.

The following table shows recorded earthquakes occurring in Utah County of Richter magnitude 3.0 or greater since 1950:

Table U-15

Date	Richter Magnitude	Epicenter
February 20, 1950	3.7	Payson
May 8, 1950	4.3	Payson
August 12, 1951	4.3	Provo
July 21, 1952	3.7	Santaquin
September 28, 1952	4.3	Lehi
July 10, 1963	4.2	Southwest of Strawberry Reservoir
March 9, 1965	3.5	20 miles south of Strawberry Reservoir
July 27, 1971	3.0	Near Lehi
August 5, 1973	3.2	Northeast of Orem
May 24, 1980	4.4	Elberta

Development Trends

As development occurs in Utah County, more buildings and people will be in danger from earthquakes. However, newer buildings will be built to better standards, which will actually decrease the risk of damage. It is interesting to note that when most residential structures are engineered, out the three categories of design criteria; seismic zone, wind shear and snow load; the design criteria for wind shear over-rules the other criteria.

Assessing Vulnerability

Please see the HAZUS-MH run in the appendix of this document for a detailed vulnerability assessment related to earthquakes.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites

For essential facilities, there are 6 hospitals in the region with a total bed capacity of 1,044 beds. There are 124 schools, 11 fire stations, 16 police stations and 1 emergency operation facilities. With respect to HPL facilities, there are 33 dams identified within the region. Of these, 22 of the dams are classified as 'high hazard'. The inventory also includes 85 hazardous material sites, 0 military installations and 0 nuclear power plants.

Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data is provided in Tables 2 and 3.

The total value of the lifeline inventory is over 3,843.00 (millions of dollars). This inventory includes over 560 kilometers of highways, 314 bridges, 0 kilometers of pipes.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

Severity Level 1:	Injuries will require medical attention but hospitalization is not needed.
Severity Level 2:	Injuries will require hospitalization but are not considered life-threatening
Severity Level 3:	Injuries will require hospitalization and can become life threatening if not promptly treated.
Severity Level 4:	Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

The following table forecasts the number of casualties that might be expected if an earthquake occurred.

Table U-16

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	40	12	2	4
	Commuting	0	0	0	0
	Education	0	0	0	0
	Hotels	16	5	1	1
	Industrial	60	18	3	6
	Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	116	35	6	11
2 PM	Commercial	2,356	733	124	245
	Commuting	2	3	4	1
	Education	948	294	50	98
	Hotels	3	1	0	0
	Industrial	439	136	23	45
	Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	3,755	1,167	201	389
5 PM	Commercial	2,054	634	108	209
	Commuting	0	0	1	0
	Education	194	60	10	20
	Hotels	5	1	0	0
	Industrial	275	85	14	28
	Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	2,528	780	133	257

Building Damage

HAZUS estimates that about 51,171 buildings will be at least moderately damaged. This is over 63% of the total number of buildings in the county. There are an estimated 6,812 buildings that will be completely destroyed. The following table summaries the expected damage by general occupancy for the buildings in the county.

Table U-17

Type	None	Slight	Moderate	Extensive	Complete
Agriculture	0	0	0	0	0
Commercial	39	95	258	251	202
Educational	1	1	4	3	3
Governmental	1	3	9	9	7
Industrial	6	14	42	44	38
Religion	1	2	5	4	3
Residential	454	1,431	2,541	1,877	1,368
Single Family	7,311	21,068	29,316	9,996	5,193
Total	7,813	22,614	32,175	12,184	6,813

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Critical Facilities

Table U-18

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	6	6	0	0
Schools	124	122	0	0
EOCs	1	0	0	1
Police Stations	16	16	0	0
Fire Stations	11	11	0	0

Fire and Debris Generation

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 13 ignitions that will burn about 0.11 sq. mi 0.01 % of the region's total area.) The model also estimates that the fires will displace about 203 people and burn about 8 (millions of dollars) of building value.

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris

The model estimates that a total of 2 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 33.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 80,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

The following table indicates the potential vulnerability assessment for liquefaction in Utah County based on GIS mapping.

Table U-19

Name	Households	Value	Population	Employment
American Fork	1,938	$290,700,000	6,467	4898
Eagle Mountain	1	$150,000	2	30
Genola	217	$32,550,000	931	
Goshen	272	$40,800,000	874	19
Lehi	2,559	$383,850,000	8,969	2598
Lindon	401	$60,150,000	1,689	3447
Mapleton	1,415	$212,250,000	5,704	957
Orem	2,423	$363,450,000	8,247	10377
Payson	2,011	$301,650,000	6,955	1901
Pleasant Grove	2,021	$303,150,000	7,145	2214
Provo	23,961	$3,594,150,000	82,056	46278
Salem	425	$63,750,000	1,516	154
Santaquin	2	$300,000	5	67
Saratoga Springs	305	$45,750,000	1,115	
Spanish Fork	3,775	$566,250,000	12,651	8020
Springville	5,743	$861,450,000	19,485	7045
Vineyard	45	$6,750,000	159	
Utah	1,942	$291,300,000	7,316	
Total	**49,456**	**$7,418,400,000**	**171,286**	

The following table lists the critical facilities that would be affected by liquefaction:

Table U-20

Affected Facilities			
NAME	ADDRESS	CITY	DESC_
National Guard Armory	251 S 200 East	American Fork	Government
Greenwood School	50 E 200 S, American Fork 8400	American Fork	School
Genola City Offices	74 W. 800 South	Genola	Government
GENOLA FIRE DEPT		Genola	Fire Station
Goshen City Offices	12 W Main	Goshen	Government
Goshen School	PO Box B, 60 N Center, Goshen	Goshen	School
GOSHEN FIRE DEPT		Goshen	Fire Station
Lehi School	765 N Center, Lehi 84043	Lehi	School
Lehi City Fire Department	176 N Center	Lehi	Fire Station
Lehi City Hall	153 N 100 East	Lehi	Government
National Guard Armory	348 E Main	Lehi	Government

Eaglecrest School	2760 N 300 W, Lehi 84043	Lehi	School
Meadow School	176 S 500 W, Lehi 84043	Lehi	School
Lehi High	180 N 500 E, Lehi 84043	Lehi	School
U. S. B. O. R. Field Materials Control Lab	3979 W 5600 North	Lindon	Government
Oak Canyon Junior High	750 E 200 S, Lindon 84042	Lindon	School
Mapleton Fire Department	35 E Maple	Mapleton	Fire Station
Mapleton City Offices	35 E Maple	Mapleton	Government
Mapleton Ambulance Office	35 E Maple	Mapleton	Ambulance
Mapleton School	120 W Maple, Mapleton 84664	Mapleton	School
MAPLETON FIRE DEPT		Mapleton	Fire Station
Vineyard School	950 W 800 S, Orem 84058	Orem	School
Payson City Offices	425 W Utah Ave	Payson	Government
Taylor School	40 S 500 W, Payson 84651	Payson	School
Wilson School	590 W 500 S, Payson 84651	Payson	School
Elementary School	600 N 1300 W, Pleasant View	Pleasant View	School
Utah Valley Regional Medical Center	1034 N 500 West	Provo	Hospital
Utah County Offices	100 E Center	Provo	Government
Provo City Hall	351 W Center	Provo	Government
Provo City Electric Energy Department	251 W 800 North	Provo	Government
Provo Ambulance Office #3	601 W Columbia Ln	Provo	Ambulance
Provo Fire Station #4	2050 W 95 South	Provo	Fire Station
Provo City Ambulance Dept #4	2050 W 95 South	Provo	Ambulance
Provo Fire Station #3	601 W Columbia Ln	Provo	Fire Station
National Guard Armory	222 W 500 North	Provo	Government
Provo Fire Station #1	80 S 300 West	Provo	Fire Station
Provo City Ambulance Office #1	80 S 300 West	Provo	Ambulance
Valley Ambulance	925 N 500 West	Provo	Ambulance
Amelia Earhart School	2585 W 200 S, Provo 84601	Provo	School
Franklin School	350 S 600 W, Provo 84601	Provo	School
Sunset View School	525 S 1600 W, Provo 84601	Provo	School
Timpanogos School	449 N 500 W, Provo 84601	Provo	School
Dixon Middle	750 W 200 N, Provo 84601	Provo	School
Farrer Middle	100 N 600 E, Provo 84606	Provo	School
Provo High	1125 N University Ave, Provo 8	Provo	School
Mt Brook/Eastwood	1300 E Center, Provo 84601	Provo	School
Utah County Health Department	589 S State	Provo	Government
Provo City Ambulance Office #2	2737 N Canyon Rd	Provo	Ambulance
Provo Fire Station #2	2737 N Canyon Rd	Provo	Fire Station
Joaquin School	550 N 600 E, Provo 84606	Provo	School
Provost School	629 S 1000 E, Provo 84606	Provo	School
Westridge School	1720 W 1460 N, Provo 84604	Provo	School
Centennial Middle	305 E 2320 N, Provo 84604	Provo	School

Salem School	140 W 100 S, Salem 84653	Salem	School
Saratoga Springs City Offices	6394 S Redwood Rd	Saratoga Springs	Government
Brockbank School	340 W 500 N, Spanish Fork	Spanish Fork	School
Spanish Fork City Offices	40 S Main	Spanish Fork	Government
Utah County Security Center	3075 N Main St.	Spanish Fork	Police Station
Spanish Fork Ambulance Station	360 N Main St.	Spanish Fork	Ambulance
Spanish Fork Fire Station	360 N Main St.	Spanish Fork	Fire Station
National Guard Armory	2801 N Main	Spanish Fork	Government
Park School	90 N 600 E, Spanish Fork 84660	Spanish Fork	School
Rees School	185 E 400 N, Spanish Fork 8466	Spanish Fork	School
Spanish Fork Middle	50 N 900 E, Spanish Fork 84660	Spanish Fork	School
Spanish Fork High	99 N 300 W, Spanish Fork 84660	Spanish Fork	School
Landmark High (Alt HS)	320 S Main, Spanish Fork 84660	Spanish Fork	School
Springville City Hall	50 S Main	Springville	Government
Springville Ambulance Office	45 S Main	Springville	Ambulance
Springville Fire Department	45 S Main	Springville	Fire Station
National Guard Armory	125 S 700 East	Springville	Government
Art City School	121 N 900 E, Springville 84663	Springville	School
Brookside School	750 E 400 S, Springville 84663	Springville	School
Grant School	105 S 400 E, Springville 84663	Springville	School
Sage Creek School	1050 S 700 E, Springville 8466	Springville	School
Westside School	570 S Main, Springville 84663	Springville	School
Springville Middle	485 S 100 E, Springville 84663	Springville	School
Springville Junior High	165 S 700 E, Springville 84663	Springville	School
Springville High	1205 E 900 S, Springville 8466	Springville	School
GENEVA STEEL FIRE DEPT		Vineyard	Fire Station
Geneva Steel Ambulance Office	10 S Geneva Rd	Vineyard	Ambulance
Vineyard City Offices	240 E Gammon	Vineyard	Government
Provo Police Dept			Police Station
Utah County Sheriffs Ofc			Police Station
Lehi City Ambulance Office	54 N Center		Ambulance
Lehi Police Dept			Police Station
Mapleton Police Dept			Police Station
Spanish Fork Police Department			Police Station
Springville Police Dept			Police Station
Utah County Justice Center			Police Station
Utah Valley State College Pd			Police Station

Mitigation Strategies

Problem Identification: Utah County will be impacted directly from an earthquake on the Wasatch Fault. There are also other smaller faults that could generate significant damage. Transportation and utilities services within County could be severely impacted.

Goal 1 – Priority High

Objective 1.1 Reduce loss of life and limit damage to property. Provide education on seismic hazards and mitigation to Utah County residents and homeowners.

Action: Develop and promote earthquake public education program.
Time Frame: Immediate
Funding: County/State
Estimated Cost: $2500.00
Staff: County Emergency Management, State Earthquake Program
Jurisdictions: Countywide
Background: Provide information to residents and business owners to encourage them to take appropriate measures to make homes and businesses less susceptible to damage from ground shaking. Education pertaining to earthquakes will be part of a holistic natural hazards education program, including wildfires, flooding, sever weather, and landslides.

Goal 2 – Priority Medium

Objective 2.1 Through the CERT Program, educate community on earthquake damage prevention practices

Action: Educate the public on damage prevention practices for earthquakes
Time Frame: 2 years
Funding: State and Federal Grants from state and Federal governments
Estimated Cost: $50,000-$75,000
Staff: County Emergency Management and volunteers
Background: Continue to support C.E.R.T. program in the County. Earthquakes preparedness techniques and guidelines can be utilized in an all-hazard approach to personal and individual preparedness.

Goal 3 – Priority Medium

Objective 3.1 Increase quality and quantity of available natural hazards data to facilitate better decision-making.

Action 1: Update fault zone and liquefaction maps for the county to a better scale
Time Frame: Two years
Funding: Undetermined, potentially USGS or UGS
Estimated Cost: Minimal
Staff: USGS Staff
Background: Provide updated, detailed maps to city and county planning groups, emergency managers, and public to assist them in making educated decisions by understanding earthquake danger zones.

Action 2: Develop better ground acceleration maps for building officials
Time Frame: Three years
Funding: UGS, USGS, State Earthquake Program, Utah Seismic Safety Commission
Estimated Cost: Unknown, some cost share for printing.
Staff: UGS

Background: Current ground accelerations maps are too small and difficult to read. Better maps create better decision-making.

The following mitigation strategies are provided so that communities may be aware of additional mitigation measures that could be used to limit the exposure to earthquake related damage.

Prevention

- Planning and Zoning
- Building construction regulation
- Regulation of other facilities (critical)

Property Protection

- Non-structural methods
- Retrofit upgrades
- Earthquake Insurance

Natural Resource Protection

- Identify Fault Rupture zones
- Identify secondary impact

Emergency Services

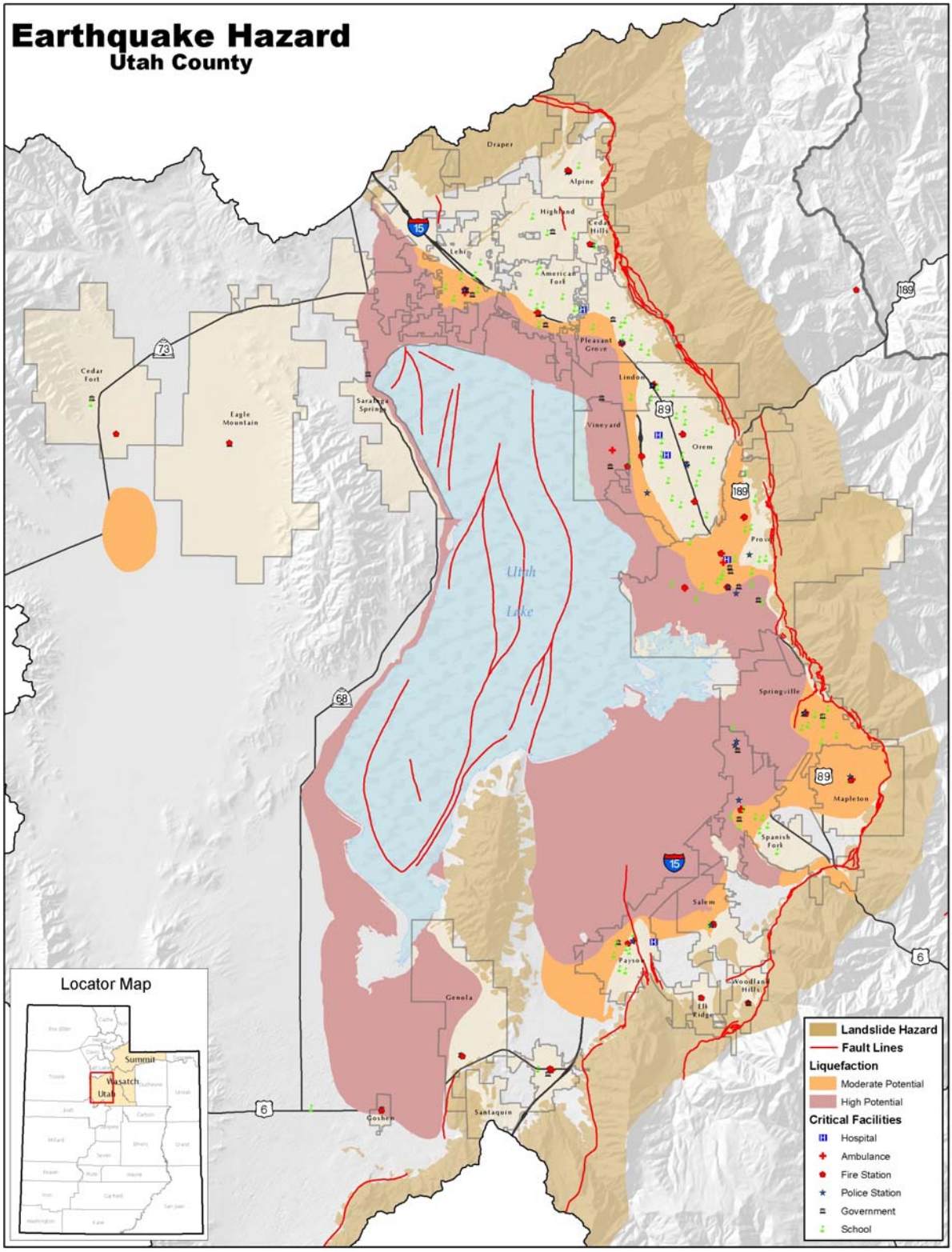
- Earthquake threat recognition
- Emergency Planning for Secondary Impact
- Emergency response (Mutual Aid, CERT)
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

Structural Projects

- Rebuild or retrofit critical facilities to higher seismic code
- Rebuild or retrofit infrastructure to higher seismic code

Public information

- Seismic maps; liquefaction, fault zones
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Education


Earthquake Hazard
Utah County
Draper
Alpine
Highland
Cedar Hills
Lehi
American Fork
Pleasant Grove
Lindon
Vineyard
Orem
Provo
Springville
Mapleton
Spanish Fork
Salem
Payson
Woodland Hills
Elk Ridge
Genola
Santaquin
Goshen
Eagle Mountain
Cedar Fort
Saratoga Springs
Utah Lake
15
89
189
73
68
6
Locator Map
Summit
Wasatch
Utah
Landslide Hazard
Fault Lines
Liquefaction
Moderate Potential
High Potential
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School

Drought

Assessing Vulnerability

Drought is a region-wide hazard that varies little between the three counties in the MAG area. The vulnerability will typically be related to agricultural production. A secondary affect of drought is the increase in vulnerability to wildfires. Many of the communities in the region have dealt with drought for a number of years. These communities have several sources for water and storage facilities. Many of the communities have secondary water systems to reduce the demand on culinary water resources. Many communities also have active water conservation programs in place.

Mitigation Strategies

Problem Identification: Cyclical periods of drought place a strain on community culinary water resources.

Goal 1 – Priority Low

Objective 1.1 Conserve culinary water by educating the public

Action 1: Educate the public on the need to be water wise
Time Frame: Ongoing
Funding: State and Federal
Estimated Cost: Minimal
Staff: Water Districts
Background: Use a newsletter to educate the public

Action 2: Coordinate with current water systems and develop a secondary water systems plan for drought
Time frame: Immediate
Funding: Undetermined local sources
Estimated Cost: Minimal
Staff: Water Districts
Jurisdictions: Countywide
Background: To reduce the demand on culinary systems it is proposed that more communities study the possibility of using secondary water for agricultural uses such as irrigation and lawn watering.

The following mitigation strategies are provided so that communities may be aware of additional mitigation measures that could be used to limit the exposure to drought related damage.

Prevention

- Establish economic incentives for water conservation
- Encourage water conservation
- Develop early warning system, monitoring programs
- Implement water metering and leak detection programs

Property Protection

- Identify potential for wildfire due to drought
- Identify secondary effects from drought
- Drought Insurance

Natural Resource Protection

- Legislation to protect stream flows
- Protect water aquifers
- Alert procedures for water quality issues
- Create inventory of pumps, filters and other equipment

Emergency Services

- Establish water hauling programs
- List livestock watering locations
- Establish hay hotline
- Fund water system improvements (wells, systems, reservoir)
- Lower well intakes
- Develop drought contingency plans
- Issue emergency permits for water use

Structural Projects

- Redesign or create new reservoir storage
- Provide pumps and piping for distribution

Public information

- Develop drought education material
- Water conservation outreach material
- Other outreach for awareness

Severe Weather/Avalanche

Assessing Vulnerability

No data is readily available for potential losses related to severe weather or avalanche, however most of the losses are limited. Severe weather may cause closure of transportation routes and fatalities due to weather related vehicular accidents. The ski resorts count on winter storms to produce the snow pack needed to operate their business. Some of the ski runs are located in avalanche prone areas, the private ski resorts as well as county public works and state road crews are aware of the potential dangers and keep the avalanche danger to a minimum. Backcountry skiers, snowboarders and snowshoe enthusiasts have the most severe threat to life related to avalanche danger. As recently as December 27, 2003 there were three snowboarder deaths in one avalanche above Sundance Ski Resort. Avalanche danger warnings are issued, however it is the individual's responsibility to assure that the warnings are heeded

The following table shows recorded snow avalanches that have occurred in Utah County:

Table U-21

Date	Location	Remarks
January 16, 1875	Summit Canyon	One Death, Property Damage
February 8, 1899	Provo Canyon	Property Damage
January 30, 1911	Provo Canyon	Property Damage
February 16, 1962	Provo Canyon	Property Damage
February 19, 1968	Rock Canyon	One Death
February 1998	Bridal Veil Falls	Property Damage
December 27, 2003	Aspen Grove	Three Deaths

The following table shows recorded lightning deaths in Utah County since 1950

Table U-22

Date	Location	Remarks
July 21, 1977	Moraine State Park	One Death, On camping trip
May 31, 1984	Mapleton	One Death, Outside during storm

The following table lists the recorded tornado for Utah County since 1950

Table U-23

Date	Location	Remarks
July 9, 1965	Provo Canyon	Two small funnel clouds
April 17, 1966	Springville	$10,000 Property Damage
December 2, 1970	Below Timpanogos Divide	Picked up snow above 8,000 ft
September 2, 1971	West shore of Utah Lake	Brief No Damage
August 13, 1984	South of Provo	No Damage
April 5, 1997	Near Allen's Ranch (Cedar Fort)	No Damage

Development Trends

Most new development is not in avalanche areas. A limited number of recreational cabins are being built in the canyon areas. Any new development should be built to withstand avalanche forces.

Mitigation Strategies

Problem: Snowstorms, summer thunderstorms, hail, and high winds over northern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 1 – Priority High

Objective 1.1 Protect County from adverse affects of severe weather

Action 1: County participate in the StormReady program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service StormReady program.

Action 2: Encourage avalanche preparedness for county backcountry users.
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal
Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Jurisdictions: Countywide
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry. While the avalanche terrain is mainly on US Forest Service land the search and rescue for the lost individual in more often than not coordinated by emergency managers with search parties comprised of county and city staff. Introductory avalanche awareness training could lessen the costs to Utah County and the cities within the county. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOCs to ensure they are grounded lightning, to include buildings with towers, etc.
Time frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Jurisdictions: Countywide
Background: Alternate EOC(s), Sheriff's Dispatch, Command Vehicle(s)and associated equipment need to be protected from severe weather events including lightning.

The following mitigation strategies are provided so that communities may be aware of additional mitigation measures that could be used to limit the exposure to Severe Weather/Avalanche related damage.

Prevention

- Early warning and notification systems
- Building codes to address wind shear and snow load
- Properly ground structures for lightning
- Public education for severe weather conditions
- Restrict development in avalanche prone areas

Property Protection

- Structural tie downs of roofs in high wind areas
- Mitigate development in areas of avalanche potential
- Monitor NWS weather warnings and watches

Natural Resource Protection

- Evaluate the impacts of severe weather
- Mitigate development in areas of avalanche

Emergency Services

- Monitor NWS weather warnings and watches
- Develop plans and exercises for severe weather

Structural Projects

- Install sheds over roads below avalanche terrain
- Install drift fences along snow drift areas
- Install avalanche fencing along ridgelines for wind blown snow
- Promote Weatherization programs

Public information

- Develop outreach document on avalanche safety
- Become a NWS Storm Ready Community
- Promote Lighting Safety Week
- Develop cold weather safety materials
- Ensure that at risk groups, such as the elderly, are checked on during severe weather

Infestation

The vulnerability assessment of Insect Infestation varies little across the county. The western area of the county has an increased vulnerability for cricket invasions, while communities around Utah Lake have an increased chance of West Nile Virus infections. For the most part, the above referenced region-wide analysis covers infestations in sufficient detail for Utah County.

The following table identifies the mitigation strategies that are the top priority for each community. The mitigation strategies where prioritized based on GIS data. The hazard identified with the highest number of household potentially affected was designated the highest priority.

Utah County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES
Table U-24

Community	Hazard	Mitigation	Cost	Responsible party	Funding Source
Alpine	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
American Fork	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Cedar Fort	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Cedar Hills	Landslides/ Flood	Participate in the NFIP/Require site-specific soils reports	$1,000	Local Gov	Local cash, grants, volunteers
Eagle Mountain	Wildfire	Educate Homeowners on Firewise practices	$1,000	Local Gov	Local cash, grants, volunteers
Elk Ridge	Wildfire/ Flood	Educate Homeowners on Firewise practices Join NFIP Flood Map Community	$1,000	Local Gov	Local cash, grants, volunteers
Genola	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Goshen	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Highland	Flood	Encourage Homeowner Participation in NFIP	N/A	Local Gov	Local cash, grants, volunteers
Lehi	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Lindon	Landslide	Prohibit development in Landslide areas	$1,000	Local Gov	Local cash, grants, volunteers
Mapleton	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Orem	Dam Failure	Establish Early Warning System	In Process	Local Gov	Local cash, grants, volunteers
Payson	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Pleasant Grove	Flood	Encourage Homeowner Participation in NFIP	N/A	Local Gov	Local cash, grants, volunteers
Provo	Dam Failure	Establish Early Warning System	In Process	Local Gov	Local cash, grants, volunteers

Salem	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Santaquin	Flood	Map flood and debris flow areas in newly annexed areas	$1,000	Local Gov	Local cash, grants, volunteers
Saratoga Springs	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Spanish Fork	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Springville	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Utah County	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Vineyard	Liquefaction	Educate Homeowners/Require mitigation on new development	$1,000	Local Gov	Local cash, grants, volunteers
Woodland Hills	Landslide	Prohibit development in Landslide areas	N/A	Local Gov	Local cash, grants, volunteers

Wasatch County

Area: 1,191 square miles; *population*: 15,215 (in 2000); *county seat*: Heber City; *origin of county name*: from the Wasatch Mountains; *principal cities/towns*: Heber City (7,291), Midway (2,121), Charleston (378), Wallsburg (274); *economy:* hay, livestock, recreation; *points of interest*: Strawberry, Deer Creek, and Jordanelle reservoirs, Wasatch Mountain State Park, Wasatch LDS Tabernacle in Heber City, Heber Creeper, historic homes in Midway.

Heber Valley, one of several back valleys in the Wasatch Mountains, is often called Utah's Switzerland because of the rugged beauty of Mount Timpanogos located to the west, its climate, and a large population of Swiss that settled in Midway. The county's highest peaks top 10,000 feet, and over half of the land is 7,500 feet above sea level. The climate zone, classified as undifferentiated highlands, offers cool summers and very cold winters. The average annual precipitation is about sixteen inches.

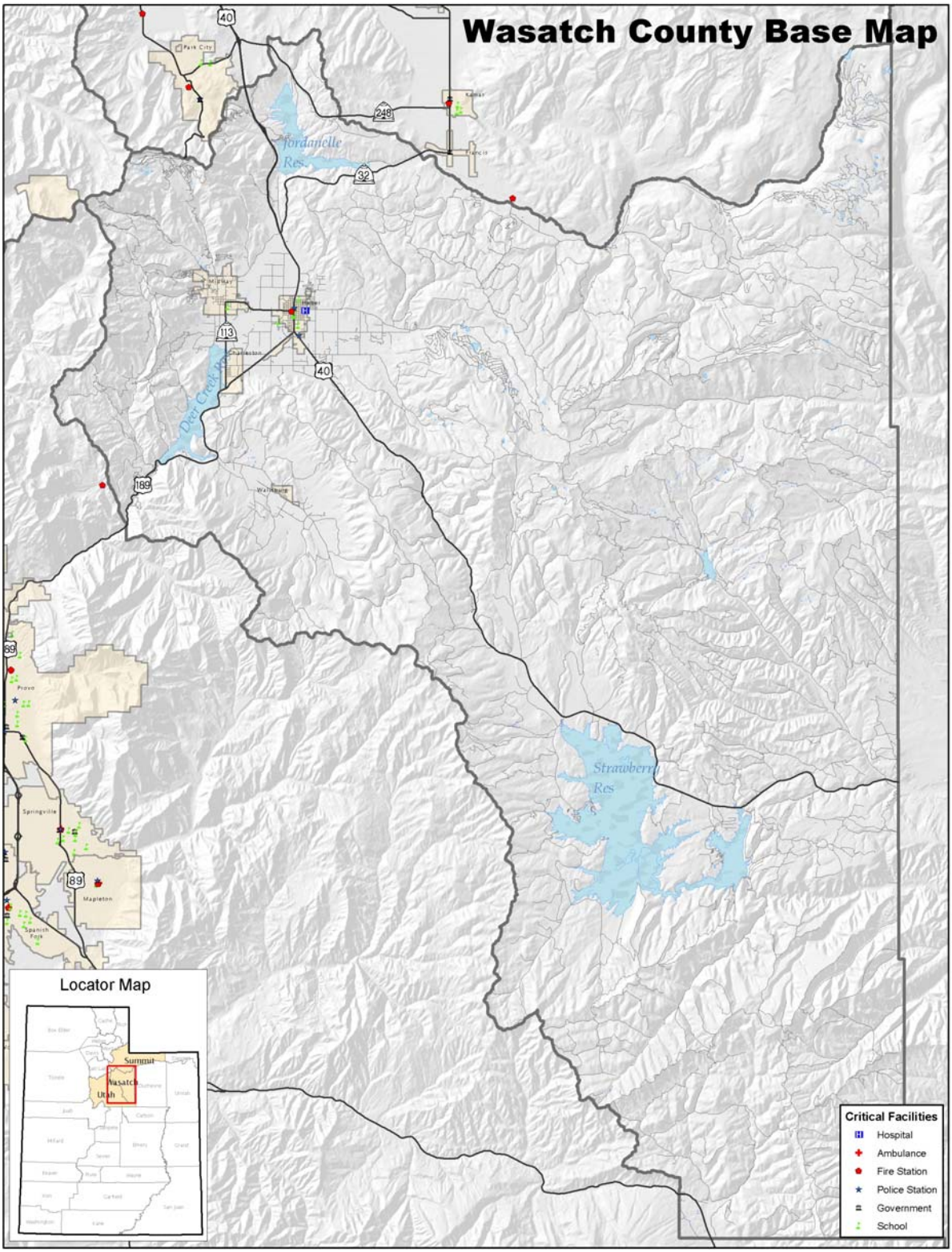
The county is divided into two watersheds--the Colorado and the Great Basin drainage systems. Because of its annual precipitation and its location between the Uinta and Wasatch mountains, Heber Valley is well endowed with water. Flowing from the east are Daniels, Lake Fork, and Center creeks. From the north and northeast is the Provo River. From the west Snake Creek drains a central portion of the Wasatch Mountains. Two additional sources of water are man-made: the Ontario Drain Tunnel west of Keetley drains many of the Park City mines, and the Weber/Provo diversion canal diverts water from the Weber across the Kamas prairie in Summit County to the Provo River in Wasatch County.

Prior to the 1850s, Heber Valley was an important summer hunting ground for the Timpanogos Utes living around Utah Lake. The first white men to visit the county were members of the Dominguez-Escalante expedition in 1776. They skirted Heber Valley, traveling down Diamond Fork to Spanish Fork Canyon and then into Utah Valley. Fifty years later fur trappers entered the county. In 1824 and 1825 Etienne Provost from Taos, New Mexico, trapped beaver in the Uinta and Wasatch mountains. About the same time, William Henry Ashley and members of his fur company from St. Louis also hunted and trapped for beaver in the county.

The first settlers came into Wasatch County from Utah Valley in the spring of 1859 and located a short distance north of present Heber City at the London or John McDonald Spring. That same year, Midway and Charleston were also settled. In 1862 the territorial legislature created Wasatch County, which then included all of the Uinta Basin. Wasatch in Ute means "mountain pass" or "low pass over high range." Heber City, named for Mormon Apostle Heber C. Kimball, was selected as the county seat.

The county produces hay, dairy products, sheep and cattle. During the early 1900s, after the Denver and Rio Grande Railroad completed a line into the county from Provo, Heber City became an important shipping terminal for wool and sheep. In 1922 the Union Pacific Railroad constructed a spur from Park City to the mines west of Keetley. Lead, zinc, and silver ore were shipped from these mines on this railroad spur. Today neither railroad line is in full operation, and other economic activities are more important to the county than transportation and mining.

Strawberry Reservoir (completed in the 1910s), Deer Creek Reservoir (completed in the 1940s), and Jordanelle Reservoir (completed in the 1990s), together with sparkling streams and beautiful mountain scenery, have made Wasatch a popular recreation area. (Source: Utah Historical Encyclopedia. Craig Fuller, Author)


Wasatch County Base Map
Jordanelle Res
Deer Creek Res
Strawberry Res
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School

Population

The following table shows historic population data:

Table W-1

	1930	1940	1950	1960	1970	1980	1990	2000
Wasatch	5,636	5,754	5,574	5,308	5,863	8,523	10,089	15,215

Economy

Wasatch County, though still largely rural in nature, has seen its economy show greater signs of life than ever before. Heber City and Midway, the two largest cities in the county, have both seen a number of new developments add some vitality and tax base to their communities. New economic development and housing plans currently being completed will no doubt add to Wasatch County's ability to focus and channel resources into the most beneficial sectors and activities.

Table W-2

Economic Indicators for Wasatch County
1997-2001

Wasatch County	1997	1998	1999	2000	2001	% Change 1999-00
Population	13,307	14,132	14,560	15,433	15,947	3.3
Employment						
-Ave civilian labor force	5,759	5,991	6,239	6,369	6,577	3.0
-Ave non-ag employment	3,817	4,097	4,686	4,698	4,727	.07
Income						
-Ave monthly non-ag wage	1,454	1,582	1,689	1,834	1,898	3.4
-Annual non-ag payroll ($000)	66,570	78,062	94,971	103,408	107,700	4.2
Total personal income ($Mil)	256	281	305	332	357	7.7
Per capita personal income	19,193	20,144	20,991	21,547	22,424	4.1
Taxes						
-Total assessed value ($Mil)	941	1,111	1,211	1,359	1,493	9.9
-Prop taxes charged ($000)	9,232	10,958	11,998	12,979	13,811	7.6
-Gross taxable sales ($000)	118,483	136,583	155,799	171,693	173,996	1.3
-Net local sales tax ($000)	1,265	1,351	1,506	1,685	1,809	7.4
Construction (permitted)						
-New Dwelling Units (#)	183	239	504	370	279	-24.6
-Value of new res. ($000)	22,586	26,514	67,744	74,751	54,062	-27.7
-Value new non-res ($000)	10,421	14,202	4,705	25,706	8,869	-65.7
-Value of total constr. ($000)	35,480	42,819	75,162	102,913	65,965	-35.9
Miscellaneous						
-Fed mineral royalties ($000)	826	434	451	73		
-Fed in lieu of taxes ($000)	291	306	318	337	503	49.3

Source: Bureau of Economic and Business Research, University of Utah.
www.business.utah.edu/bebr/Counties/wasatch.htm

Flood
Risk Assessment

Wasatch County

Table W-3

COUNTY	CITY/TOWN	POPULATION	STATE MAP LOCATION	NFIP STATUS	THREAT (or NSFHA-eligible)
Wasatch	Unincorporated	5718		490164A - 10/1/86(L)	Provo River & Tributaries
Wasatch	Charleston	378	E5	490165 - 8/5/80(M)	
Wasatch	Heber City	7291	D5	490166 - 3/18/87	
Wasatch	Midway	1554	D5	490167 - 8/19/80(M)	
Wasatch	Wallsburg	274	E5	Not Participating	Spring & Main Creeks

Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.

Wasatch County Flood and Dam failure History

Table W-4

Hazards	Date	Location	Critical Facility or Area Impacted	Comments
Flood Wasatch Presidential	Spring 1983	Wasatch County	Uncontrolled flooding washed out culverts, bridges, public and private roads. Irrigation systems along with livestock holding fences, corrals were destroyed. 2.5 miles of the Heber Creep track was destroyed.	
		Heber City	Clogged culverts, and flooding damage to residential, commercial and public property.	
Flood Wasatch Presidential	Spring 1984	County wide	Damage to stream banks, culverts, bridges, structures, and roadways near or along streams.	County damage was estimated at $646,526.

(All dollar values for given are for year of disaster)
Source: Flood Hazard Identification Study: Mountainland Association of Governments, US Army Corps of Engineers, September 3, 2003.

Assessing Vulnerability

Table W-5

Roads				
City	County	Type of Road	Length in Miles	Value
	Wasatch		1.28	$2,560,000
	Wasatch	Connecting road, county roads	1.98	$3,960,000
	Wasatch	Jeep trail,	0.5	$1,000,000
	Wasatch	Neighborhood roads	29.07	$58,140,000
	Wasatch	Secondary road, U.S. highway	2.55	$6,154,425
Charleston	Wasatch		0.04	$80,000
Charleston	Wasatch	Connecting road, county roads	0.07	$140,000

Charleston	Wasatch	Neighborhood roads	0.38	$760,000
Charleston	Wasatch	Secondary road, U.S. highway	0.19	$458,565
Midway	Wasatch		0.25	$500,000
Midway	Wasatch	Neighborhood roads	0.53	$1,060,000
Wallsburg	Wasatch	Connecting road, county roads	0.14	$280,000
Wallsburg	Wasatch	Neighborhood roads	0.22	$440,000
		Total	37.2	$75,532,990

Table W-6

Utilities				
City	County	Type of Line	Length in Miles	Value
Charleston	Wasatch	KV-12.5 or less	0	$0
	Wasatch	KV-12.5 or less	2	$96,560
	Wasatch	KV-138	0	$0
	Wasatch	KV-46	1	$48,280
	Wasatch	Owned by others	0	$0
		Total	**3**	**$144,840**

Wasatch County Flood Mitigation Goals

Problem Identification: Flood occurs primarily from spring snow-melt and occasionally from localized summer thunderstorms. Identifying and then controlling flooding will assist in responding to flood events. Protection of life and property before, during, and after a flooding event is essential.

Goal 1 – Priority High

Objective 1.1 Encourage 100% participation in the National Flood Insurance Program (NFIP).

Action: Assist the Town of Wallsburg in joining NFIP
Time Frame: 1 year
Funding: None required
Estimated Cost: None
Staff: County Emergency Management, County Engineer, State Floodplain Manager
Jurisdictions: Wallsburg
Background: FEMA has yet to map the Town of Wallsburg with Special Flood Hazards (SFHA). The community does not participate in the NFIP therefore flood insurance is not available.

Objective 1.2 Promote flood insurance throughout the County

Action: Create outreach documents promoting flood insurance for inclusion in local newspaper(s), libraries, and other public buildings.
Time Frame: 1 year
Funding: Minimal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager, DES
Jurisdictions: Countywide
Background: General public is usual not aware they can purchase flood insurance.

Objective 1.3 Reduce threat of unstable canals throughout the County. Identify County-wide canal systems

Action: Map and assess for structural integrity canal systems in the County
Time Frame: 3-5 years
Funding: Federal grants
Estimated Cost: Unknown
Staff: County Engineer, County Public Works, County Information and Technology, County Emergency Management
Jurisdictions: Countywide
Background: Private and Public canals are used for transportation and dispersion of water as well as flood control.

Objective 1.4 Reduce flooding threat in Midway, Heber, Charleston, and Wallsburg.

Action: Clear debris and other material from streams prior to spring snow melt.
Time Frame: Ongoing
Funding: None
Estimated Cost: Unknown
Staff: County Public Works
Jurisdictions: Countywide
Background: Most flooding is attributed to debris-laden streams.

Objective 1.5 Ensure EOC(s) is equipped to respond to flooding.

Action: Obtain communication equipment that will allow for timely response to flooding.
Time Frame: 1 year
Funding: Federal Grants
Estimated Cost: $30,000
Staff: County Sheriff, County Emergency Management
Jurisdictions: Wasatch County
Background: An alternate EOC is being considered in Kamas. An adequate communication capability is essential between all response agencies within the County.

Objective 1.6 Support updating of flood hazard data

Action: Support and encourage participation in the NFIP Flood Map Mod Program.
Time Frame: Ongoing
Funding: Federal
Estimated Cost: Unknown
Staff: County Engineer, State Floodplain Manager
Jurisdictions: Countywide
Background: Accurate flood maps assist the County in the administration of the NFIP and better reflects flood risk within the County.

Mitigation Strategies

The following mitigation strategies are provided so that communities may be aware of additional measure that could be used to limit the exposure to flood related damage.

Prevention

- Planning and Zoning
- Floodplain open space preservation
- Building construction regulation
- Regulation of other facilities (critical)
- Stormwater management

Property Protection

- Relocation
- Acquisition
- Building elevation
- Flood proofing
- Lifeline protection
- Flood Insurance

Natural Resource Protection

- Wetlands protection
- Erosion and sediment control

Emergency Services

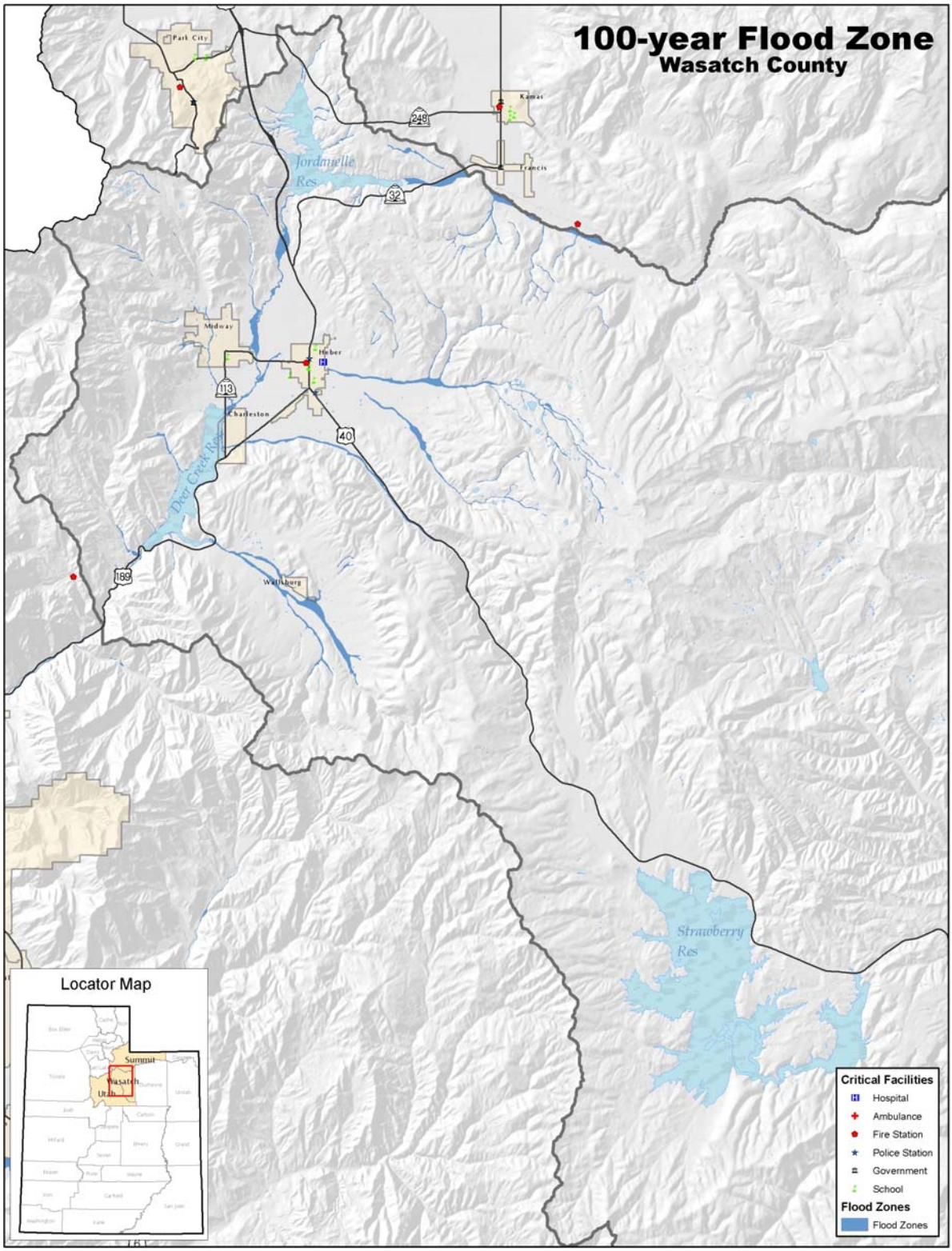
- Flood threat recognition
- Warning dissemination
- Flood response
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

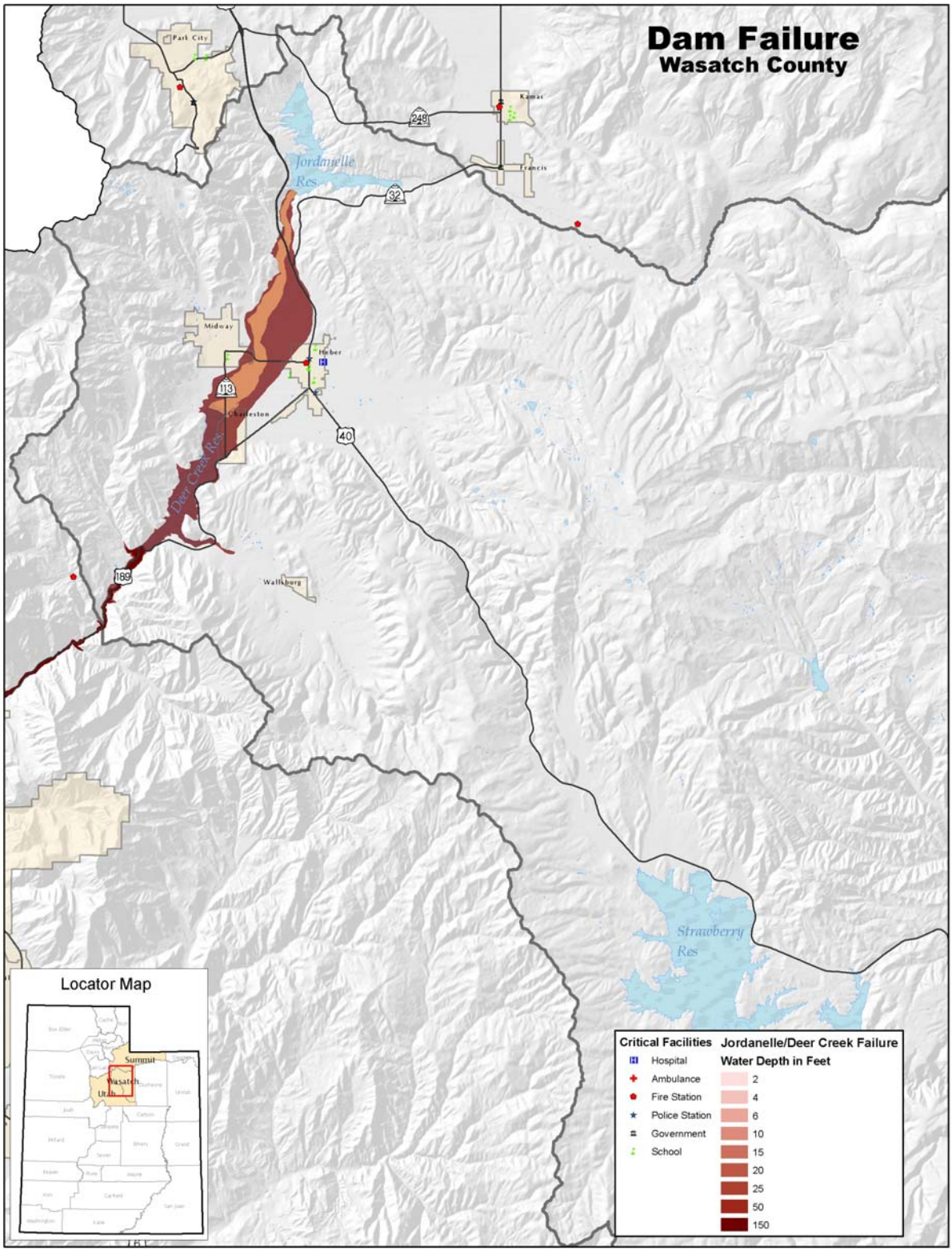
Structural Projects

- Reservoirs/impounds
- Levees
- Diversions
- Channel and drainage modifications
- Channel and basin maintenance

Public information

- Flood Hazard maps
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Environmental education


100-year Flood Zone
Wasatch County
Park City
Kamas
Francis
Jordanelle Res
Midway
Heber
Charleston
Deer Creek Res
Wallsburg
Strawberry Res
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Flood Zones
Flood Zones


Dam Failure
Wasatch County
Park City
Kamas
Francis
Jordanelle Res
Midway
Heber
Charleston
Deer Creek Res
Wallsburg
Strawberry Res
248
32
113
40
189
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Jordanelle/Deer Creek Failure
Water Depth in Feet
2
4
6
10
15
20
25
50
150

Wildland Fire

Assessing Vulnerability

Wildland fire is a big concern in the Wasatch County area. On August 24, 1990, the most devastating urban wildland interface wildfire (URWIN) to have occurred in Utah began just west of the Heber Valley and lasted for six days, burning nearly 3,000 acres until it was officially contained. The Wasatch Mountain Fire, as it is referred to now, killed two firefighter, destroyed 18 homes and cost the state approximately $1.42 million in fire suppression. The overall loses were estimated to be about $2 million. Following this wildfire, precautions were taken in Midway for flash flooding and the NRCS Emergency Watershed Protection Program (EWP) was implemented with emergency flash flood mitigation measures.

Due to this fire a grant was received to implement a Children's Wildfire Mitigation Awareness Program. In the summer of 2003, a second wildfire, also started by the Forest Service, this time in the Cascade Springs area of Utah County, got out of control and burned into Wasatch County. The original "Prescribed" Burn was to be about 600 acres. The wildfire consumed more than 8,000 acres and threatened homes in the Midway area. Mudflows from the burned areas may have a negative effect on water quality in the Deer Creek Reservoir. There was considerable concern on the part of Wasatch County Officials that Forest Service Officials would not let the County aid in fighting the fire.

The following GIS based analysis indicates the vulnerability analysis for Wildland Fire in Wasatch County

Table W-6

NAME	County	Population	Households	Value
Charleston	Wasatch	84	27	$4,050,000
Wasatch	Wasatch	2,462	748	$112,200,000
Total		2,546	775	$116,250,000

The following Table lists the Wildfires over 100 acres

Table W-7

FIRE_ID	YEAR	NAME	SDATE	CAUSE	COUNTY	TYPE	SIZE
3436-2000	2000	East Vivian	7/26/2000	LT	Wasatch	Wildland	328
	1990	Wasatch Mtn	8/24/1990	FS	Wasatch	Wildland	>3,000
	2003	Cascade Springs	9/22/2003	FS	Wasatch	Wildland	>8,000

Timberlakes Project Report

Due to increasing Wildland fire activity in the western US and in particular, the terrible Wildland fire season of 2000, the National Fire Plan was developed. In 2001, the Timberlakes community, a Wildland Urban/Interface community, was listed as the #2 Wildland Hazard Risk in the State of Utah. This community is a mixture of permanent and seasonal residents with over 500 homes and 3,000 people located in the Lake Creek region approximately five (5) miles east of Heber City.

The State of Utah, Division of Forestry, Fire and State Lands, in collaboration with the Timberlakes Homeowners Association Board, Timberlakes residents, The Church of Jesus Christ of Latter-Day Saints. Wasatch County, and the US Forest Service, applied for a hazardous fuel reduction grant. This grant was approved for $20,400. The grant objectives were to primarily educate and undertake an assessment of the severity of the wildfire hazard faced by the individual homeowners. The remaining objective of the grant was to demonstrate how these hazards could be mitigated through the use of a demonstration of defensible space around the homes and a perimeter fuel break. The project was not intended to "mitigate all of the wildfire hazards" faced by the community.

The risk in the Timberlakes community was evaluated using the Division of Forestry, Fire, and State Lands wildfire hazard rating criteria. Risk factors included poor road access, lack of a reliable water system, fuel loading within the subdivision, and fire history. Following this evaluation, an action plan was developed for further action. This consisted of providing information and education to Timberlakes residents, homeowner and community action, and hazardous fuel reduction. Lot assessments were completed for 342 lots of which 300 were rated high, 16 were rated extreme, and 26 were rated as moderate, with an overall rating of high. As a response to the lot assessment program and education efforts significant interest in creating defensible space resulted with 107 lots doing some kind of fuel reduction and approximately 1,000 tons of slash removed.

As a result of these activities, the Timberlakes community has taken the first step and the initial response by the partners to continue. So it is very important that the initial work completed is maintained and the creation of defensible space and proactive community involvement continues in the future.

Mitigation Strategies–Wildland Fire

Problem Identification: **N**on-compliance with best firewise practices.

Goal 1 – Priority High

Objective 1.1 Increase compliance with existing building and fire codes.

Action: Develop and enforce current local, state and national codes
Time Frame: Ongoing
Funding: Local budgets
Estimated Cost: Unknown
Staff: Local, state and federal agencies
Jurisdictions: Countywide
Background: Implement and enforce rules, regulations and codes

Problem Identification: Building continues to be of concern in Urban Wildfire Interface Areas (URWIN).

Goal 2 – Priority High

Objective 1.1 Educate homeowners on how to reduce risk of wildfire damage

Action 1: Conduct an education program (Firewise) on reducing wildfire risks
Time Frame: Ongoing
Funding: County
Estimated Cost: Minimal

Staff: Fire District(s), County Emergency Management, and State FFSL
Jurisdictions: Countywide
Background: Educate homeowners using newsletters and personal contacts of the importance of clearing combustibles from perimeters of their homes and defensible space. The Utah Living With Fire Committee has created a Utah specific wildfire education-training package. GIS analysis conducted by Mountainland Association of Government indicates the county has 775 structures costing $116,250,000 vulnerable to wildfire in Wasatch County.

Action 2: Complete mitigation detailed in the wildfire plan prepared for the community of Interlaken Estates.
Time Frame: 3 years
Funding: County, State and Federal
Estimated Cost: Unknown
Staff: Private land owners, Interlaken Community Fire Council, County Public Works, County Emergency Management, Fire District, State Forestry Fire and State Lands, US Forest Service
Jurisdictions: Interlaken Estates
Background: Wildfires have the potential to threaten this area. These community specific mitigation strategies will assist in protecting the community.

Action 3: Continue to coordinate with current Firewise communities.
Time Frame: Ongoing
Funding: County, State and Federal Grants
Estimated Cost: Minimal
Staff: County Emergency Management, State FFSL, US Forest Service
Jurisdictions:
Background: It is essential we continue to promote wildfire mitigation actions and educate homeowners on wildfire risks.

The following mitigation strategies have been provided so that communities may be aware of additional measures that could be used to limit the exposure to Wildland Fire related damage.

Prevention

- Zoning ordinances to reflect fire risk zones
- Regulate development areas near fire protection and water resources
- Planning to include: spacing of buildings, firebreaks, on-site water storage, wide roads, multiple access
- Code standards for roof materials and fire protection systems
- Maintenance programs to clear dead and dry brush
- Regulations on open fires
- Open space around structures

Property Protection

- Retrofitting roofs, add spark arrestors
- Create and maintain defensible space
- Insurance
- Eliminate ladder fuels
- Install sprinkler systems

- Develop fire resistant plans
- Have home addresses clearly displayed
- Clean out rain gutters

Natural Resource Protection

- Require mitigation of development in high-risk areas
- Understand impact of non-native vegetation
- Promote tread soft ATV use
- Develop watershed management plans
- Maintain watersheds
- Establish and promote fuel reduction

Emergency Services

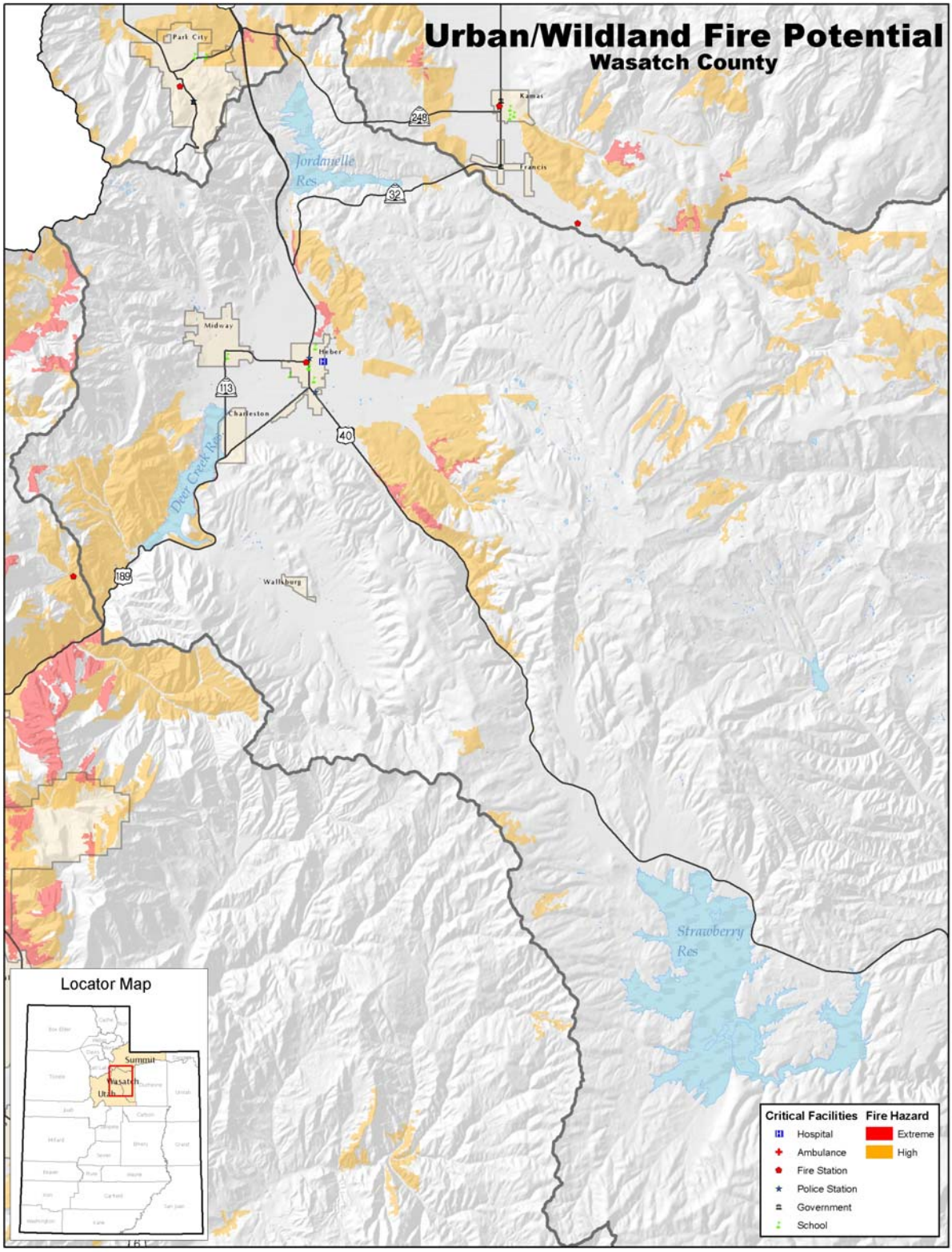
- Mutual aid agreement for fire fighting
- Participate in State Wildfire Suppression Fund
- Develop and exercise local wildfire response plan and evacuation plans

Structural Projects

- Construct wildfire fuel breaks
- Install Heliport water stations
- Tree and underbrush thinning in critical areas
- Increase the number of fire hydrants
- Install water tanks

Public information

- Develop maps for wildfire hazard areas
- Mail wildfire information to owners high-risk structures
- Develop urban wildfire “How to protect your home from Wildfires” book
- Publish newspaper articles on wildfires
- Presentations on wildfires at community meetings
- Develop displays for public buildings and events
- Real estate disclosure of high hazard wildland fire area


Urban/Wildland Fire Potential
Wasatch County
Park City
Kamas
Francis
Jordanelle Res
Midway
Heber
Charleston
Deer Creek Res
Wallsburg
Strawberry Res
Locator Map
Summit
Wasatch
Utah
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Fire Hazard
Extreme
High

Landslide/Problem Soils

Assessing Vulnerability

The Utah Interagency Technical Team (IAT) has worked with Wasatch County in 1999 due to extensive landslide complexes identified by the Utah Geological Survey in the Timber Lakes area and also in several mountain communities on the west side of the Heber Valley. In one such area of Timber Lakes, more than 200 homes are in a Landslide Study Area of the UGS. Thus, the UGS has completed, and is still conducting, Landslide Hazard and Risk Analysis for Timber Lake and other communities. These reports can be obtained from the UGS.

The following table is from a GIS analysis of active landslides in Wasatch County than the data being produced for the Timber Lakes area.

Table W-8

County	City	Population	Households	Type
Wasatch		371	138	Deep Seated
Wasatch		1066	338	LS and LS/talus/colluvial/etc
Wasatch	Midway	20	9	LS and LS/talus/colluvial/etc

Development Trends

As development continues on the foothills of the Heber Valley, more houses may be in danger of landslides. Wasatch County is currently restricting development in the Timber Lakes area.

Mitigation Strategies

Problem Identification: There is a potential risk to structures located in areas identified by the MAG GIS analysis and UGS study as landslide risk areas. Several areas in Wasatch County are particularly vulnerable they include the Provo river area down stream from Deer Creek Reservoir, Timber Lakes area, and several communities on the west side of Heber Valley.

Goal 1 – Priority Medium

Objective 1.1 Reduce potential landslide risk on commercial, residential structures, and infrastructure (pipelines and utilities) in areas of known landslide potential.

Action 1: Assess the probability of landslides and identify specific structures and infrastructure at risk
Time Frame: Undetermined
Funding: County Engineer, County Emergency Management, County Public Works, Utilities, Developers and Property Owners
Estimated Cost: Unknown
Staff: Unknown
Jurisdictions: Countywide
Background: Soil surveys and other engineering surveys are needed.

Action 2: Include landslide data in County Information and Technology GIS system and include on County website.
Time Frame: Undetermined
Funding: County, possible grants
Estimated Cost: To be determined
Staff: County GIS Staff, UGS,
Jurisdictions: Countywide
Background: General public and developers will have access to landslide data.

Action 3: Map landslide risk areas for inclusion in site development ordinances. These ordinances should include at a minimum a natural hazards disclosure clause.
Time Frame: Undetermined
Funding: County Engineer, County Emergency Management, County Public Works, Utilities, Developers and Property Owners
Estimated Cost: Unknown
Staff: Unknown
Jurisdictions: Countywide
Background: Soil surveys and other engineering surveys are needed.

The following mitigation strategies are provided so that communities may be aware of additional methods that could be used to limit the exposure to landslide/Problem Soils related damage.

Prevention

- Planning and zoning restrictions and regulations
- Open Space
- Building Codes
- Drainage system maintenance
- Monitor and evaluate areas after wildfire
- Install ground monitoring instruments on landslide-prone areas
- Establish codes (grading, construction, excavation) in landslide prone areas

Property Protection

- Insurance
- Remove soil
- Ensure rain gutters and sprinklers are directed away from structures
- Control and monitor surface and ground water drainage
- Control building in areas of landslides
- Evaluate property maintenance in areas of landslides (over watering)
- Plan proper valving of waterlines to ensure quick turn off in the event of a waterline break

Natural Resource Protection

- Leave area as open space
- Identify structures impacted by problem soils
- Complete a watershed management plan
- Limit use of ATVs in areas off landslides to manage erosion
- Evaluate impact of wildfire in areas of landslides
- Mitigate development in landslide-prone areas
- Maintain natural vegetation

Emergency Services

- Identify structures impacted by problem soils
- Monitor and warning systems
- Evacuation plans and exercises
- Critical Facilities Protection
- Equip emergency crews with water valve shut-off keys

Structural Projects

- Pre-soak and/or compact soils
- Install drain fields
- Bring in structural fill
- Build buttress, retaining walls and other engineered structures
- Install subsurface drainage materials
- Remove potential landslide debris

Public information

- Develop information on problem soils
- Outreach information on problem soil mitigation
- Map soils and landslide areas
- Real estate disclosure
- Notice to homeowners in landslide areas detailing hazard
- Library
- Technical Assistance
- Education

Earthquake

Assessing Vulnerability

The following table shows recorded earthquakes occurring in Wasatch County since 1950

Table W-9

Date	Richter Magnitude	Epicenter
August 17, 1963	3.9	12 miles northeast of Strawberry Reservoir
October 1, 1972	3.8	Near Heber
October 2, 1972	3.2	Near Heber
December 24, 1972	3.0	Near Heber
August 5, 1973	3.4	Deer Creek Reservoir
August 19, 1973	3.4	South of Heber

Please see the HAZUS-MH Earthquake event report for Utah County 2500 year event, print date October 20, 2003 in the appendix of this document for full details of vulnerability. According to the HAZUS-MH run, about 35% or 2,093 buildings will be damaged and that 138 buildings will be completely destroyed

The geographical size of the region is 2,138.07 square miles and contains 85 census tracts. There are over 99 thousand households in the region and has a total population of 368,536 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 81 thousand buildings in the region with a total building replacement value (excluding contents) of 16,313 (millions of dollars). Approximately 99.00 % of the buildings (and 83.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,997 and 846 (millions of dollars), respectively.

Development Trends

As development occurs in Wasatch County, more buildings and people will be in danger from earthquakes. However, newer buildings will be built to better standards, which will actually decrease the risk of damage. It is interesting to note that when most residential structures are engineered, out the three categories of design criteria; seismic zone, wind shear and snow load; the design criteria for wind shear over-rules the other criteria.

Assessing Vulnerability

Please see the HAZUS-MH run in the appendix of this document for a detailed vulnerability assessment related to earthquakes.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites

For essential facilities, there is 1 hospital in the region with a total bed capacity of 16 beds. There are 6 schools, 1 fire station, 2 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 26 dams identified within the region. Of these, 13 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data is provided in Tables 2 and 3.

The total value of the lifeline inventory is over 949.00 (millions of dollars). This inventory includes over 165 kilometers of highways, 24 bridges, 0 kilometers of pipes.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

The following table forecasts the number of casualties that might be expected if an earthquake occurred.

Table W-10

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Education	0	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Residential	9	2	0	0
	Single Family	46	11	1	3
	Total	57	13	2	3
2 PM	Commercial	38	11	2	3
	Commuting	0	0	0	0
	Education	9	3	0	1
	Hotels	0	0	0	0
	Industrial	7	2		1
	Residential	2	0	0	0
	Single Family	8	2	0	0
	Total	65	18	3	5
5 PM	Commercial	35	10	2	3
	Commuting	0	0	0	0
	Education	0	0	0	0
	Hotels	0	0	0	0
	Industrial	4	1	0	0
	Residential	4	1	0	0
	Single Family	18	4	1	1
	Total	61	16	2	5

Building Damage

HAZUS estimates that about 2,093 buildings will be at least moderately damaged. This is over 35% of the total number of buildings in the county. There are an estimated 138 buildings that will be completely destroyed. The following table summaries the expected damage by general occupancy for the buildings in the county.

Table W-11

Type	None	Slight	Moderate	Extensive	Complete
Agriculture	0	0	0	0	0
Commercial	5	6	10	6	3
Educational	0	0	0	0	0
Governmental	0	1	1	1	0
Industrial	0	0	0	0	0
Religion	0	0	0	0	0
Residential	22	49	98	78	24
Single Family	1,674	2,067	1,436	324	111
Total	1,702	2,123	1,545	410	139

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Critical Facilities

Table W-12

Classification	Total	Least Moderate Damage >50%	Complete Damage > 50%	Functionality >50% at day 1
Hospitals	1	0	0	0
Schools	6	0	0	0
EOCs	0	0	0	0
Police Stations	2	0	0	0
Fire Stations	1	0	0	1

Fire and Debris Generation

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 2 ignitions that will burn about 0.03 sq. mi 0.0 % of the region's total area.) The model also estimates that the fires will displace about 22 people and burn about 1 (millions of dollars) of building value.

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris

The model estimates that a total of 0 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 35.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Mitigation Strategies

Problem Identification: Wasatch County will be impacted indirectly from an earthquake on the Wasatch Front. Transportation and utilities services to and from the County could be severely impacted.

Goal 1 – Priority Low

Objective 1.1 Provide for emergency response and relief.

Action: Identify and maintain critical transportation and utility services
Time Frame: Ongoing
Funding: Grants
Estimated Cost: Unknown Determined by the extent of anticipated damage.
Staff: County
Jurisdictions: Countywide
Background: Critical transportation systems need to be maintained.

Problem Identification: Lack of public awareness about earthquake damage prevention practices.

Goal 2 – Priority Medium

Objective 2.2 Through the CERT Program, educate community on earthquake damage prevention practices

Action: Educate the public on damage prevention practices for earthquakes
Time Frame: 2 years
Funding: State and Federal Grants from state and Federal governments
Estimated Cost: $50,000-$75,000
Staff: County Emergency Management and volunteers
Jurisdictions: Countywide
Background: Continue to support C.E.R.T. program in the County. Earthquakes preparedness techniques and guidelines can be utilized in an all-hazard approach to personal and individual preparedness.

The following mitigation strategies are provided so that communities may be aware of additional measures that could be used to limit the exposure to earthquake related damage.

Prevention

- Planning and Zoning
- Building construction regulation
- Regulation of other facilities (critical)

Property Protection

- Non-structural methods
- Retrofit upgrades
- Earthquake Insurance

Natural Resource Protection

- Identify Fault Rupture zones
- Identify secondary impact

Emergency Services

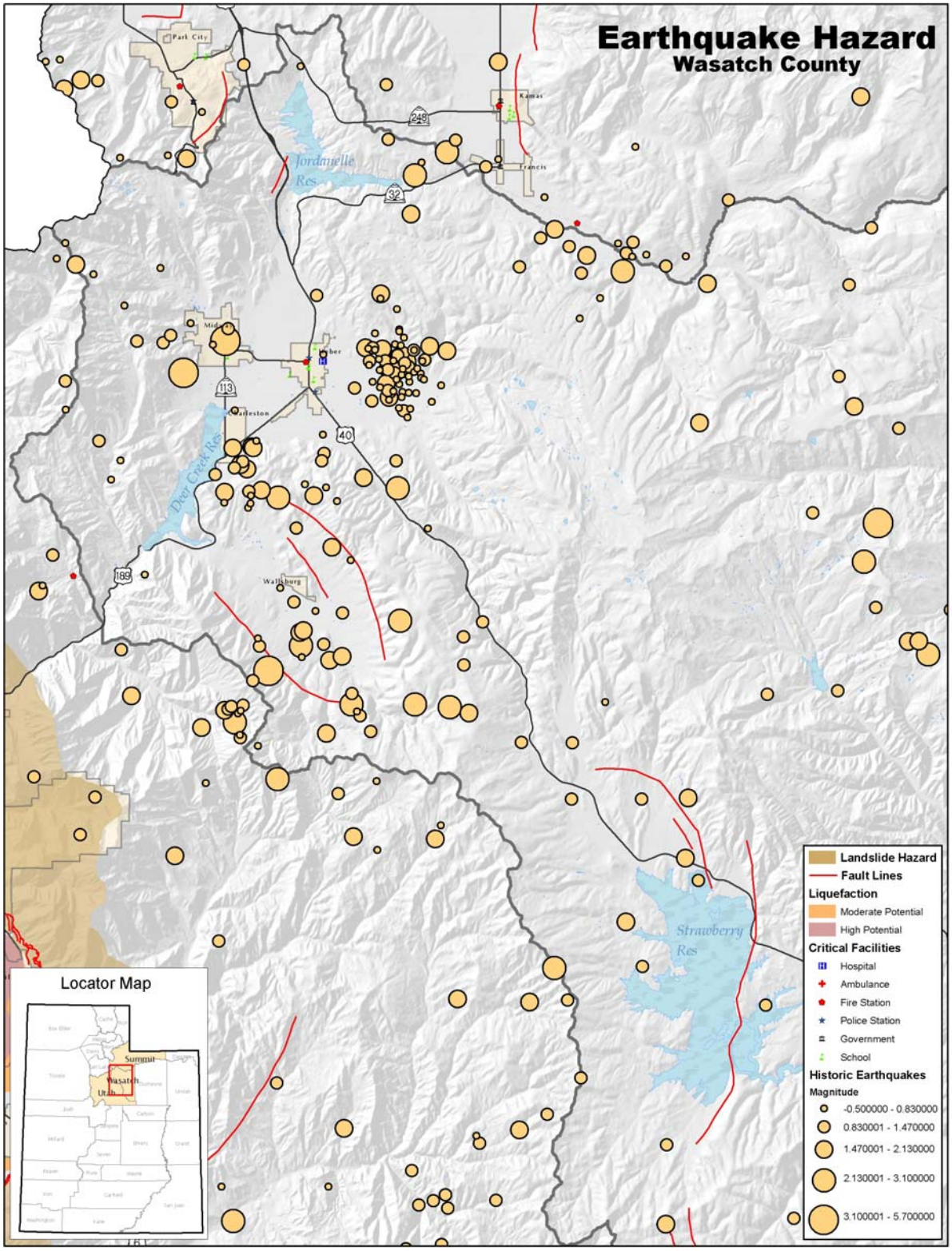
- Earthquake threat recognition
- Emergency Planning for Secondary Impact
- Emergency response (Mutual Aid, CERT)
- Critical Facilities Protection
- Health and safety maintenance
- Post-Disaster recovery and mitigation

Structural Projects

- Rebuild or retrofit critical facilities to higher seismic code
- Rebuild or retrofit infrastructure to higher seismic code

Public information

- Seismic maps; liquefaction, fault zones
- Map Information
- Outreach projects
- Real estate disclosures
- Library
- Technical Assistance
- Education


Earthquake Hazard
Wasatch County
Park City
Kamas
Francis
Jordanelle Res
Deer Creek Res
Strawberry Res
Wallsburg
Landslide Hazard
Fault Lines
Liquefaction
Moderate Potential
High Potential
Critical Facilities
Hospital
Ambulance
Fire Station
Police Station
Government
School
Historic Earthquakes
Magnitude
-0.500000 - 0.830000
0.830001 - 1.470000
1.470001 - 2.130000
2.130001 - 3.100000
3.100001 - 5.700000
Locator Map
Summit
Wasatch
Utah

Drought

Assessing Vulnerability

Drought is a region-wide hazard that varies little between the three counties in the MAG area. The vulnerability will typically be related to agricultural production. A secondary affect of drought is the increase in vulnerability to wildfires. Many of the communities in the region have dealt with drought for a number of years. These communities have several sources for water and storage facilities. Many of the communities have secondary water systems to reduce the demand on culinary water resources. Many communities also have active water conservation programs in place.

Mitigation Strategies

Problem Identification: Cyclical periods of drought place a strain on community culinary water resources.

Goal 1 – Priority Low

Objective 1.1 Conserve culinary water by educating the public

Action 1: Educate the public on the need to be water wise
Time Frame: Ongoing
Funding: State and Federal
Estimated Cost: Minimal
Staff: Water Districts
Jurisdictions: Countywide
Background: Use a newsletter to educate the public

Action 2: Coordinate with current water systems and develop a secondary water systems plan for drought
Time frame: Immediate
Funding: Undetermined local sources
Estimated Cost: Minimal
Staff: Water Districts
Jurisdictions: Countywide
Background: To reduce the demand on culinary systems it is proposed that more communities study the possibility of using secondary water for agricultural uses such as irrigation and lawn watering.

The following mitigation strategies are provided so that communities may be aware of additional measures that could be used to limit the exposure to drought related damage.

Prevention

- Establish economic incentives for water conservation
- Encourage water conservation
- Develop early warning system, monitoring programs
- Implement water metering and leak detection programs

Property Protection

- Identify potential for wildfire due to drought
- Identify secondary effects from drought
- Drought Insurance

Natural Resource Protection

- Legislation to protect stream flows
- Protect water aquifers
- Alert procedures for water quality issues
- Create inventory of pumps, filters and other equipment

Emergency Services

- Establish water hauling programs
- List livestock watering locations
- Establish hay hotline
- Fund water system improvements (wells, systems, reservoir)
- Lower well intakes
- Develop drought contingency plans
- Issue emergency permits for water use

Structural Projects

- Redesign or create new reservoir storage
- Provide pumps and piping for distribution

Public information

- Develop drought education material
- Water conservation outreach material
- Other outreach for awareness

Severe Weather/Avalanche

Assessing Vulnerability

No data is readily available for potential losses related to severe weather or avalanche, however most of the losses are limited. Severe weather may cause closure of transportation routes and fatalities due to weather related vehicular accidents. The ski resorts count on winter storms to produce the snow pack needed to operate their business. Some of the ski runs are located in avalanche prone areas, the private ski resorts as well as county public works and state road crews are aware of the potential dangers and keep the avalanche danger to a minimum. Backcountry skiers, snowboarders and snowshoe enthusiasts have the most severe threat to life related to avalanche danger. Avalanche danger warnings are issued, however it is the individual's responsibility to assure that the warnings are heeded

The following table shows recorded lightning deaths in Wasatch County since 1950

Table W-13

Date	Location	Remarks
July 1, 1990	Strawberry Reservoir	One Death, Sitting at picnic table
October 1, 2003	Strawberry Reservoir	One Death, loading boat on trailer

Development Trends

Most new development is not in avalanche areas. A limited number of recreational cabins are being built in the canyon areas. Any new development should be built to withstand avalanche forces.

Mitigation Strategies

Problem: Snowstorms, summer thunderstorms, hail, and high winds over northern Utah have a dramatic effect on regional commerce, transportation, and daily activity and are a major forecast challenge for local meteorologists.

Goal 1 – Priority High

Objective 1.1 Protect County from adverse affects of severe weather

Action 1: County participation in the Storm Ready program.
Time Frame: 2 Year
Funding: State and Federal
Estimated Cost: Unknown
Staff: City and County Emergency Management
Jurisdictions: Countywide
Background: Set up within the county emergency management and encourage all cities to participate, all requirements of the National Weather Service Storm Ready program.

Action 2: Encourage avalanche preparedness and education for county backcountry users.
Time Frame: 1 Year
Funding: Minimal
Estimated Cost: Minimal

Staff: County Emergency Management State Hazard Mitigation Team members, Utah Avalanche Forecast Center.
Jurisdictions: Countywide
Background: Avalanches and avalanche preparedness is not often considered when discussing mitigation on the county or city level, yet several people die each year in Utah's backcountry, these figures when taken cumulatively result in avalanches be Utah's most deadly natural disaster. While the avalanche terrain is mainly on US Forest Service land the search and rescue efforts are conduct by City and County staff for the lost individual. Introductory avalanche awareness training could lessen search and rescue costs to Wasatch County and the cities within the county. Most avalanche victims die in avalanches started by themselves or someone in there party. Thus, education can limit the number of avalanche related searches each year.

Action 3: Assess EOCs to ensure they are grounded lightning, to include buildings with towers, etc.
Time frame: 2-3 years
Funding: Federal Grants
Estimated Cost: Unknown
Staff: County Emergency Management
Jurisdictions: Countywide
Background: Alternate EOC(s), Sheriff's Dispatch, Command Vehicle(s)and associated equipment need to be protected from sever weather events including lightning.

The following mitigation strategies are provided so that communities may be aware of additional methods that could be used to limit the exposure to Severe Weather/Avalanche related damage.

Prevention

- Early warning and notification systems
- Building codes to address wind shear and snow load
- Properly ground structures for lightning
- Public education for severe weather conditions
- Restrict development in avalanche prone areas

Property Protection

- Structural tie downs of roofs in high wind areas
- Mitigate development in areas of avalanche potential
- Monitor NWS weather warnings and watches

Natural Resource Protection

- Evaluate the impacts of severe weather
- Mitigate development in areas of avalanche

Emergency Services

- Monitor NWS weather warnings and watches
- Develop plans and exercises for severe weather

Structural Projects

- Install sheds over roads below avalanche terrain
- Install drift fences along snow drift areas
- Install avalanche fencing along ridgelines for wind blown snow
- Promote Weatherization programs

Public information

- Develop outreach document on avalanche safety
- Become a NWS Storm Ready Community
- Promote Lighting Safety Week
- Develop cold weather safety materials
- Ensure that at risk groups, such as the elderly, are checked on during severe weather

Dam Failure

Assessing Vulnerability

This issue is a multi-county problem. For more information please see the detailed data in the Risk Assessment in this document.

Based on a GIS Analysis the following roads could be impacted by the failure of Jordanelle Dam.

Table W-14

County	Description	City	Length
Wasatch	Other		1.2
Wasatch	Connecting road, county roads, and roads not classified as A10 or A20, undivided		4.01
Wasatch	Neighborhood roads, city streets and unimproved roads, undivided		33.06
Wasatch	Secondary road, U.S. highway not classified A10, and state roads, undivided		9.46
Wasatch	Other	Charleston	0.07
Wasatch	Connecting road, county roads, and roads not classified as A10 or A20, undivided	Charleston	1.13
Wasatch	Neighborhood roads, city streets and unimproved roads, undivided	Charleston	5.28
Wasatch	Secondary road, U.S. highway not classified A10, and state roads, undivided	Charleston	0.96
Wasatch	Connecting road, county roads, and roads not classified as A10 or A20, undivided	Heber City	0.28
Wasatch	Neighborhood roads, city streets and unimproved roads, undivided	Heber City	1.09
Wasatch	Connecting road, county roads, and roads not classified as A10 or A20, undivided	Midway	0.37
Wasatch	Neighborhood roads, city streets and unimproved roads, undivided	Midway	2.56

Also based on a GIS Analysis the following power lines could be impacted by the failure of Jordanelle Dam.

Table W-15

County	Type	City	Length
Wasatch	KV-12.5 or less	Charleston	0
Wasatch	KV-12.5 or less		4
Wasatch	KV-138		0

Mitigation

Problem: National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for 34% of all dam failures. Foundation defects, including settlement and slope instability, account for 30% of all failures. Piping and seepage cause 20% of national dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The remaining 16% of failures are caused by other means. The towns of Charleston, Midway, and Heber are down stream from the Jordanelle Reservoir. Dam failure inundation study show significant flooding to all three towns.

Goal 1 – Priority Medium

Objective 1.1 Obtain most up to date and accurate information on dams in County to protect lives and property from dam failure.

Action 1: Include dam inundation maps in current County EOP.
Time Frame: 3-5 Years
Funding: Undetermined
Estimated Cost: $ 10,000.00
Staff: County Emergency Management, BOR and State Dam Safety
Jurisdictions: Charleston, Midway, Heber.
Background: Maps are not current and need to reflect impact on new residential and commercial properties. Utah Division of Water Rights Dam Safety Section in currently reviewing the maps as well as digitizing them. Digitized dam failure inundation maps will aid Wasatch County in future emergency management planning.

Action 2: Evaluate need and associated cost to have dam failure early warning sirens for communities of Charleston, Heber, and Midway.
Time Frame: 3- 5 years
Funding: Undetermined
Cost: Unknown
Staff: County Emergency Management, County Public Works, and BOR
Jurisdictions: Charleston, Heber, and Midway
Background: Charleston, Heber, and Midway could be directly impacted by a dam failure.

Action 3: Maintain rigorous dam safety inspections.
Time Frame: Ongoing
Funding: Operating budgets of inspecting agencies.
Cost: Unknown
Staff: County Emergency Management, County Public Works, and BOR
Jurisdictions: Charleston, Heber, and Midway
Background: Charleston, Heber, and Midway could be directly impacted by a dam failure.

Infestation

Infestation is a region-wide issue. Please see the information on this topic in the risk assessment section of this document.

The following table identifies the mitigation strategies that are the top priority for each community. The mitigation strategies where prioritized based on GIS data. The hazard identified with the highest number of households potentially affected was designated the highest priority.

Wasatch County Communities
PRIORITIZATION OF INDIVIDUAL COMMUNITY
MITIGATION STRATEGIES
Table W-16

Community	Hazard	Mitigation	Cost	Responsible party	Funding Source
Charleston	Dam Failure	Establish an early warning system	Unknown	BOR	Federal Government, grants
Heber	Dam Failure	Establish an early warning system	Unknown	BOR	Federal Government, grants
Midway	Wildfire	Distribute Information on Firewise Communities	$1,000	Local Gov	Local cash, grants, volunteers
Wallsburg	Wildfire	Distribute Information on Firewise Communities	$1,000	Local Gov	Local cash, grants, volunteers
Wasatach County	Wildfire	Distribute Information on Firewise Communities	$1,000	Local Gov	Local cash, grants, volunteers

Part V Plan Maintenance

Plan Maintenance Procedures

Monitoring, Evaluating and Updating the Plan

Periodic monitoring and reporting of the Plan is required to ensure that the goals and objectives for the Mountainland Region are kept current and that local mitigation efforts are being carried out. The Plan has therefore been designed to be user-friendly in terms of monitoring implementation and preparing regular progress reports.

Annual Reporting Procedures

The Plan shall be reviewed annually, as required by the Executive Council, or as situations dictate such as following a disaster declaration. Each year the MAG Community Development Department Staff will review the plan and ensure the following:

1. The Executive Director and the Executive Council will receive an annual report and/or presentation on the implementation status of the Plan at the January Executive Council Meeting.

2. The report will include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the Plan.

3. The report will recommend, as appropriate, any required changes or amendments to the Plan.

If the MAG Executive Council determines that a modification of the Plan is warranted, the Council may initiate a Plan amendment.

Revisions and Updates

Periodic revisions and updates of the Plan are required to ensure that the goals and objectives for the Mountainland Region are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes. This portion of the Plan outlines the procedures for completing such revisions and updates.

Five (5) Year Plan Review

The entire plan including any background studies and analysis should be reviewed every five (5) years to determine if there have been any significant changes in the Mountainland Region that would affect the Plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques and changes to Federal or State legislation are examples of changes that may affect the condition of the Plan.
The Pre-Disaster Hazard Mitigation Plan Ad-Hoc Committee, with a potential membership representing every jurisdiction in the MAG area, will be reconstituted for the five (5) year review/update process. Typically, the same process that was used to create the original plan will be used to prepare the update.

Further, following a disaster declaration, the Plan will need to be revised to reflect on lessons learned or to address specific circumstances arising out of the disaster.

The results of this five (5) year review should become summarized in the annual report prepared for this Plan under the direction of the Community Development Director. The annual report will include an

evaluation of the effectiveness and appropriateness of the Plan, and will recommend, as appropriate, any required changes or amendments to the Plan.

If the Executive Council determines that the recommendations warrant modification to the Plan, the Council may either initiate a Plan amendment as described below, or, if conditions justify, may direct the MAG Community Development Department to undertake a complete update of the Plan.

Plan Amendments

An amendment to the Plan should be initiated only by the Executive Council, either at its own initiative or upon the recommendation of the Executive Director, Community Development Director, Mayor of an affected community or the State Department of Emergency Services and Homeland Security.

Upon initiation of an amendment to the Plan, Mountainland will forward information on the proposed amendment to all interested parties including, but not limited to, all affected city or county departments, residents and businesses. Depending on the magnitude of the amendment, the full Ad-Hoc committee may be reconstituted or the MAG Regional Growth Committee may review the amendment. At a minimum, the information will be made available through public notice in a newspaper of general circulation and on the Mountainland Website at www.mountainland.org. Information will also be forwarded to the Utah Department of Public Safety, Division of Emergency Services and Homeland Security. This information will be sent out in order to seek input on the proposed Plan amendment for not less than a forty-five (45) day review and comment period.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to the Executive Director (or his/her designee) for consideration. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The Executive Director (or his/her designee) will review the proposed amendment along with comments received from other parties and submit a recommendation to the Executive Council within sixty (60) days.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered:

There are errors or omissions made in the identification of issues or needs during the preparation of the Plan; and/or

New issues or needs have been identified which were not adequately addressed in the Plan; and/or

There has been a change in information, data or assumptions from those on which the Plan was based.

The nature or magnitude of risks has changed.

There are implementation problems, such as technical, political, legal or coordination issues with other agencies.

Upon receiving the recommendation of the Executive Director or his/her designee, the Executive Council will hold a public hearing. The Executive Council will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the Executive Council will take one of the following actions:

1. Adopt the proposed amendment as presented.
2. Adopt the proposed amendment with modifications.
3. Refer the amendment request back to the Executive Director for further consideration.
4. Defer the amendment request for further consideration and/or hearing.
5. Reject the amendment request.

Implementation through Existing Programs

Process

The Mountainland Association of Governments Pre-Disaster Hazard Mitigation Plan will be implemented through the Capital Improvement Plans (CIP) of each local jurisdiction. It will be the responsibility of Mayor/Council/Commissioner(s) of each jurisdiction, as he/she/they see fit, to ensure these actions are carried out no later than the target dates unless reasonable circumstances prevent their implementation (i.e. lack of funding availability).

Prioritization

For this plan projects were prioritized using that STAPLEE method and given a rating of high, medium or low. These rankings were reviewed by the Ad-Hoc Committee listed in Table 3.2 on page 22. The projects were also reviewed by the local elected officials in an Executive Council meeting in February 2004. The Planning Advisory Committee comprised of planners from each jurisdiction in the Utah County also reviewed and commented on the projects. These rating take into account the following evaluation criteria: social, technical, administrative, political, legal, and funding. Emphasis was given to funding which is a fundamental consideration in any hazard mitigation project. The projects were prioritized by the number of households potentially impacted by the hazard. Benefit cost analysis was not formally conducted on any of the projects suggested in the mitigation strategies. With few exceptions, none of the projects in the plan were developed far enough to derive a meaningful benefit to cost ratio. Should funding become available the extent by which benefits are maximized with regard to cost, would play a significant roll in determining which, projects get funded and which do not.

Administrative

Project administration is purely a function of project size and complexity, for given jurisdictions within the planning area. Jurisdictions have self-funded or received state and federal funding for numerous projects in the past. The larger the project the more administration resources are needed. Local jurisdictions with current staff could administer small projects or request county or state assistance. Larger projects would most likely still by managed “in-house” but would require additional staff be hired and may request state technical assistance.

Funding Sources

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. The Mountainland jurisdictions will continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment. This portion of the Plan identifies the primary Federal and State grant programs for Mountainland jurisdictions to consider, and also briefly discusses local and non-governmental funding sources.

Federal

The following federal grant programs have been identified as funding sources which specifically target hazard mitigation projects:

Title: Pre-Disaster Mitigation Program
Agency: Federal Emergency Management Agency

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential Disaster Declaration. The Pre-Disaster Mitigation (PDM) program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property.

The funding is based upon a 75% Federal share and 25% non-Federal share. The non-Federal match can be fully in-kind or cash, or a combination. Special accommodations will be made for "small and impoverished communities", who will be eligible for 90% Federal share/10% non-Federal.
FEMA provides PDM grants to states that, in turn, can provide sub-grants to local governments for accomplishing the following eligible mitigation activities:

- State and local hazard mitigation planning
- Technical assistance (e.g. risk assessments, project development)
- Mitigation Projects
- Acquisition or relocation of vulnerable properties
- Hazard retrofits
- Minor structural hazard control or protection projects
- Community outreach and education (up to 10% of State allocation)

Title: Flood Mitigation Assistance Program
Agency: Federal Emergency Management Agency

FEMA's Flood Mitigation Assistance program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 USC 4101) with the goal of reducing or eliminating claims under the NFIP.

FMA is a pre-disaster grant program, and is available to states on an annual basis. This funding is available for mitigation planning and implementation of mitigation measures only, and is based upon a 75% Federal share/25% non-Federal share. States administer the FMA program and are responsible for selecting projects for funding from the applications submitted by all communities within the state. The state then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Title: Hazard Mitigation Grant Program
Agency: Federal Emergency Management Agency

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistant Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

To meet these objectives, FEMA can fund up to 75% of the eligible costs of each project. The state or local cost-share match does not need to be cash; in-kind services or materials may also be used. With the passage of the Hazard Mitigation and Relocation Assistance Act of 1993, federal funding under the HMGP is now based on 15% of the federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster.

The HMGP can be used to fund projects to protect either public or private property, so long as the projects in question fit within the state and local governments overall mitigation strategy for the disaster area, and comply with program guidelines. Examples of projects that may be funded include the acquisition or relocation of structures from hazard-prone areas, the retrofitting of existing structures to protect them from future damages; and the development of state or local standards designed to protect buildings from future damages.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. These organizations must apply for HMPG project funding on behalf of their citizens. In turn, applicants must work through their state, since the state is responsible for setting priorities for funding and administering the program.

Title: Public Assistance (Infrastructure) Program, Section 406
Agency: Federal Emergency Management Agency

FEMA's Public Assistance Program, through Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, provides funding to local governments following a Presidential Disaster Declaration for mitigation measures in conjunction with the repair of damaged public facilities and infrastructure. The mitigation measures must be related to eligible disaster related damages and must directly reduce the potential for future, similar disaster damages to the eligible facility. These opportunities usually present themselves during the repair/replacement efforts.

Proposed projects must be approved by FEMA prior to funding. They will be evaluated for cost effectiveness, technical feasibility and compliance with statutory, regulatory and executive order requirements. In addition, the evaluation must ensure that the mitigation measures do not negatively impact a facility's operation or risk from another hazard.

Public facilities are operated by state and local governments, Indian tribes or authorized tribal organizations and include:

- Roads, bridges & culverts
- Draining & irrigation channels
- Schools, city halls & other buildings
- Water, power & sanitary systems
- Airports & parks

Private nonprofit organizations are groups that own or operate facilities that provide services otherwise performed by a government agency and include, but are not limited to the following:

- Universities and other schools
- Hospitals & clinics
- Volunteer fire & ambulance
- Power cooperatives & other utilities
- Custodial care & retirement facilities
- Museums & community centers

Title: SBA Disaster Assistance Program
Agency: US Small Business Administration

The SBA Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses to repair or replace uninsured disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible, along with non-profit organizations.

SBA loans can be utilized by their recipients to incorporate mitigation techniques into the repair and restoration of their business.
Title: Community Development Block Grants
Agency: US Department of Housing and Urban Development

The community Development Block Grant (CDBG) program provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants fro post-disaster hazard mitigation and recovery following a Presidential disaster declaration. Funds can be used for activities such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and for the redevelopment of disaster areas.

STATE PROGRAMS

See the Capabilities Assessment Annex of this document for a full description of the State Programs available.

LOCAL

Local governments depend upon local property taxes as their primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine and regular basis to the general public. If local budgets allow, these funds are used to match Federal or State grant programs when required for large-scale projects.

NON-GOVERNMENTAL

Another potential source of revenue for implementing local mitigation projects are monetary contributions from non-governmental organizations, such as private sector companies, churches, charities, community relief funds, the Red Cross, hospitals, Land Trusts and other non-profit organizations.

Paramount to having a plan deemed to be valid is its implementation. There is currently no new fiscal note attached to the implementation of this Plan.

Continued Public Involvement

Throughout the planning process, public involvement has been and will be critical to the development of the Plan and its updates. On a yearly basis the plan will be profiled at Mountainland's Annual Open House, which is held in the fall of every year. There are typically 250-300 local citizens who attend the Open House. The plan will also be available on the MAG website to provide additional opportunities for public participation and comment.

Mountainland Association of Governments staff has been designated by its Executive Council as the lead agency in preparing and submitting the Mountainland Pre-Disaster Hazard Mitigation Plan, which includes coverage for all incorporated cities and counties within the three county region, i.e. Summit, Utah and Wasatch Counties. The strategy of the Association of Governments in preparing the plan is to use available resources and manpower in the most efficient and cost effective manner to allow our cities and counties continued access to data, technical planning assistance and FEMA eligibility. In addition, the AOG will reach out to non-profits, public agencies, special needs organizations, groups and individuals in allowing them input and access to the plan. With limited resources, however, it becomes difficult to both identify and to individually contact the broad range of potential clients that may stand to benefit from the plan. This being the case, we have established the following course of action:

STEP 1. The AOG will publicly advertise all hearings, requests for input and meetings directly related to the Pre-Disaster Hazard Mitigation Plan process. Executive Council meetings where plan items are discussed and where actions are taken will not receive special notifications as they are already advertised according to set standards. All interested parties are welcome and invited to attend such meetings and hearings as they are public and open to all. Advertisement will be done according to the pattern set in previous years, i.e. the AOG will advertise each hearing and request for input at least seven days (7) in advance of the activity and will publish notices of the event in the Provo Herald, the Wasatch Wave and the Summit County Bee. The notices will advertise both the hearing and the means of providing input outside the hearing if an interested person is unable to attend.

STEP 2. The AOG has established a mailing list of many local agencies and individuals that may have an interest in the Pre-Disaster Hazard Mitigation Plan. Each identified agency or person will be mailed a notice of the hearings and open houses.

STEP 3. Comments, both oral and written, will be solicited and accepted from any interested party. Comments, as far as possible, will be included in the final draft of the Hazard Mitigation Plan; however, the AOG reserves the right to limit comments that are excessively long due to the size of the Plan.

STEP 4. Specific to risk assessment and hazard mitigation, needs analysis, and capital investment strategies, the AOG will make initial contact and solicitation for input from each incorporated jurisdiction within the region. All input is voluntary. Staff time and resources do not allow personal contact with other agencies or groups, however, comments and strategies are welcomed as input to the planning process from any party via regular mail, FAX, e-mail, phone call, etc. In addition, every public jurisdiction advertises and conducts public hearings on their planning, budget, etc. where most of these mitigation projects are initiated. Input can be received from these prime sources by the region as well.

STEP 5. The final draft of the Hazard Mitigation Plan will be presented to the Mountainland Executive Council at its regularly scheduled monthly meeting for adoption and approval to submit the document to State authorities. Executive Council policies on adoption or approval of items will be in force and adhered to. This document is intended to be flexible and in constant change so comments can be taken at any time of the year for consideration and inclusion in the next update. Additionally, after FEMA approval of the Plan, the Plan will be promulgated for each local jurisdiction for adoption by resolution.

STEP 6. The following policies will guide AOG staff in making access and input to the Hazard Mitigation Plan as open and convenient as possible:

A. Participation: All citizens of the region are encouraged to participate in the planning process, especially those who may reside within identified hazard areas. The AOG will take whatever actions possible to accommodate special needs of individuals including the impaired, non-English speaking, persons of limited mobility, etc.

B. Access to Meetings: Adequate and timely notification to all area residents will be given as outlined above to all hearings, forums, and meetings.

C. Access to Information: Citizens, public jurisdictions, agencies and other interested parties will have the opportunity to receive information and submit comments on any aspect of the Hazard Mitigation Plan, and/or any other documents prepared for distribution by the Association of Governments that may be adopted as part of the plan by reference. The AOG may charge a nominal fee for printing of documents that are longer than three pages.

D. Technical Assistance: Residents as well as local jurisdictions may request assistance in accessing the program and interpretation of mitigation projects. AOG staff will assist to the extent practical, however, limited staff time and resources may prohibit staff from giving all the assistance requested. The AOG will be the sole determiner of the amount of assistance given all requests.

E. Public Hearings: The AOG will plan and hold public hearings according to the following priorities: 1- Hearings will be conveniently timed for people who might benefit most from Mitigation programs, 2- Hearings will be accessible to people with disabilities (accommodations must be requested in advance according to previously established policy), and 3- Hearings will be adequately publicized.

Hearings may be held for a number of purposes or functions including to: a-identify and profile hazards, b-develop mitigation strategies, and c-review plan goals, performance, and future plans.

F. Comment Period: The AOG will sponsor a 30-day public comment period prior to final plan submission. The comment period will begin with a public hearing to open the 30-day solicitation of input. Comments may be made orally, or in writing, and as far as possible, will be included in the final Pre-Disaster Hazard Mitigation Plan according to the outlined participation rules.

Part VI Additional State Requirements Capability Assessment

INTRODUCTION

What follows is a description of the organizational, technical and political capacity of the Mountainland Region to implement hazard mitigation strategies and goals. The best plan in the world will do nothing to improve hazard mitigation efforts in the region without sufficient implementation capacity and capability; particularly local level capacity (town, city and county government). The purpose of this section is to analyze gaps and potential capability weaknesses for local level jurisdictions in the region.

LOCAL ORGANIZATIONAL AND TECHNICAL CAPABILITY

Only a handful of communities in the Mountainland region have full time professional staff of any kind. In many cases a limited tax base means that hiring full time professional staff in the smaller cities and towns is financially unobtainable. Often these smaller communities rely on local volunteers or elected and appointed officials to perform many of the tasks normally handled by professional staff. It's not uncommon to have a volunteer city council persons or planning commissioner assigned the task of emergency management, grant writing or long range planning. Professional staff at MAG (and each of the three counties to some degree) help provide some technical and planning assistance to these smaller communities. This regional assistance is often limited by staffing capacity and funding. As funding allows, some communities are able to contract for professional services from private consultants.

Only Provo City and Orem City have staffs that are, for the most part, dedicated full time to emergency management related tasks. While Summit, Utah and Wasatch Counties have emergency managers, all of these individuals have other responsibilities in addition to core emergency management functions.

Table 6.1: State and Regional Hazard Mitigation Resources
MAG District

Agency/Group	Description
Utah Div. of Emergency Services and Homeland Security	Training, technical assistance and funding.
Utah League of Cities and Towns	Training, technical assistance and planning assistance
Utah Geologic Survey	Technical assistance, plan review
Mountainland Association of Governments	Technical assistance, plan review, GIS and Community Development Block Grants.
Local Health Departments	Emergency preparedness and response. Homeland security planning.
Local Chapters of the American Red Cross	Training, emergency preparedness and response.
Utah Association of Conservation Districts	Technical assistance and planning assistance.

Table 6.2: Local Level Hazard Mitigation Capability MAG District		
Jurisdiction	**Professional Staffing (e.g. City Manger, Engineer, Planner)**	**Technical Capacity (In House)**
SUMMIT COUNTY	County Emergency Management Coordinator , County Planner, Public Works, Building Inspector	GIS Staffing and equipment
Coalville	Volunteer\contracted consultant	None
Francis	Volunteer\contracted consultant	None
Henefer	Volunteer\contracted consultant	None
Kamas	Police, Planner, Public Works, Consultant	None
Oakley	Police, Planner, Public Works, Consultant	None
Park City	Emergency Manager, Planning Department, Public Works	GIS Staffing and equipment
UTAH COUNTY	Countywide Planner, Emergency Manager, Sheriff	Advanced GIS capability with customized application to Emergency Management.
Alpine	City Administrator, Planner, Public Works	None
American Fork	Chief of Staff, Public Works, Police	GIS Capability and staffing
Cedar Fort	Volunteer\contracted consultant	None
Cedar Hills	City Administrator, Planner, Public Works	None
Eagle Mountain	City Administrator, Planner, Public Works	Some GIS Capability
Elk Ridge	Planner, Volunteer	Some GIS Capability
Genola	Volunteer\contracted consultant	None
Goshen	Volunteer\contracted consultant	None
Highland	City Administrator, Planner, Public Works	None
Lehi	City Administrator, Planner, Public Works	GIS Capability and staffing
Lindon	City Administrator, Planner, Public Works	Some GIS Capability
Mapleton	City Administrator, Planner, Public Works	None
Orem	Emergency Management Department, Planning Department, City Engineers & Public Works.	Advanced GIS capability with customized application to Emergency Management.
Payson	City Administrator, Planner, Public Works	None
Pleasant Grove	City Administrator, Planner, Public Works	Some GIS Capability
Provo	Emergency Management Department, Planning Department, City Engineers & Public Works.	Advanced GIS capability with customized application to Emergency Management.
Salem	City Administrator, Public Works	None
Santaquin	City Administrator, Planner, Public Works	Some GIS Capability
Saratoga Springs	City Administrator, Planner, Public Works	Some GIS Capability
Spanish Fork	City Administrator, Planner, Public Works	Some GIS Capability
Springville	City Administrator, Planner, Public Works	Some GIS Capability
Vineyard	Volunteer\contracted consultant	None
Woodland Hills	Volunteer\contracted consultant	None

Table 6.2: Local Level Hazard Mitigation Capability MAG District		
Jurisdiction	**Professional Staffing (e.g. City Manger, Engineer, Planner)**	**Technical Capacity (In House)**
WASATCH COUNTY	County Administrator, Countywide Planner , Emergency Manager, Sheriff	Advanced GIS capability with customized application to Emergency Management.
Charleston	Volunteer\contracted consultant	None
Heber	City Administrator, Planner, Public Works	Some GIS Capability
Midway	City Administrator, Planner, Public Works	Some GIS Capability
Wallsburg	Volunteer\contracted consultant	None

POLICY AND PROGRAM CAPABILITY

All thirty-six jurisdictions in the MAG Region have an adopted General Plan. Although many communities have recently updated their General Plan, many are very outdated and have not been revised in years. Generally speaking, if these plans address natural hazards at all, it is usually limited to flood related hazards.

All of the thirty-six municipalities have an adopted zoning ordinance. Again, often these ordinances are outdated and often are not consistent with the jurisdiction's General Plan. Most zoning ordnances do not address natural hazards in any way. A few communities have a "sensitive area" or "hazard area" overlay zone. All communities issue building permits and enforce local building codes. Often this service is contracted for with the county.

Many of the smaller communities lack emergency response plans.

Authority

Federal: Public Law 93-288 as amended, established the basis for federal hazard mitigation activity in 1974. A section of this Act requires the identification, evaluation, and mitigation of hazards as a prerequisite for state receipt of future disaster assistance outlays. Since 1974, many additional programs, regulations, and laws have expanded on the original legislation to establish hazard mitigation as a priority at all levels of government. When PL 93-288 was amended by the Stafford Act, several additional provisions were also added that provide for the availability of significant mitigation measures in the aftermath of Presidentially declared disasters. Civil Preparedness Guide 1-3, Chapter 6- Hazard Mitigation Assistance Programs places emphasis on hazard mitigation planning directed toward hazards with a high impact and threat potential.

The Disaster Mitigation Act of 2000 was signed into Law on October 30, 2000. Section 322, defines mitigation planning requirements for state, local, and tribal governments. Under Section 322 States are eligible for an increase in the Federal share of hazard mitigation (HMGP), if they submit for approval a

mitigation plan, which is a summary of local and/or regional mitigation plans, that identifies natural hazards, risks, vulnerabilities, and describes actions to mitigate the hazards, risks and vulnerabilities in that plan.

State: The State of Utah derives it's authority under the Emergency Management Act of 1981 (Utah Code 53-2, 63-5) as well as the Governor's Emergency Operations Directive and Executive Order of the Governor 11.

Association of Governments: The Association of Governments have been duly constituted under the authority of Title XI, Chapter13, Utah Code Annotated, 1953, as amended (The Inter-local Cooperation Act) and pursuant to Section 3 of the Executive Order of the Governor of the State of Utah, dated May 27, 1970, with the authority to conduct planning studies and to provide services to its constituent jurisdictions.

Local: Utah Code, Title 17, Chapter 27 is the County Land Use Development and Management Act that grants authority to counties. Utah Code, Title 10 Chapter 9 grants similar authority to municipalities.

The state of Utah maintains a philosophy of local responsibility for hazard mitigation. State agencies still provide an integrated network of support, services, and resources for hazard mitigation activities. As demonstrated during past disasters, these agencies are well organized in their delivery and coordination of services. The following is a review of State departments with disaster responsibilities describing their existing and planned mitigation programs.

An evaluation of the laws, regulations, authorities, policies, and programs used in Utah to mitigate hazards demonstrate that they work exceptionally well, as evidenced by the massive amount of mitigation accomplished in Utah, the few numbers of disasters, and the limited nature of those emergencies that do occur. According to the Utah SHMT, the only changes that could be considered by the Legislature might be ones that parallel the Federal Disaster Mitigation Act of 2000, which would integrate predisaster mitigation considerations into the code of various state agencies.

Utah Division of Emergency Services and Homeland Security

For Associated state laws see "Authority" at the beginning of this plan.

Capabilities of DESHS Hazard Mitigation Program
Prepare, implement, and maintain programs and plans to provide for preventions and minimization of injury and damage caused by disasters.
Identify areas particularly vulnerable to disasters.
Coordinate hazard mitigation and other preventive and preparedness measures designed to eliminate or reduce disasters.
Assist local officials in designing local emergency actions plans.
Coordinate federal, state, and local emergency activities.
Coordinate emergency operations plans with emergency pans of the federal governments.

Through the State Hazard Mitigation Program, the following occurs:

- Provides a state coordinator for hazard mitigation, the State Hazard Mitigation Officer.
- Provides a central location of the coordination of state hazard mitigation activities.
- Provides coordination for the Federal Pre-Disaster Mitigation Program.
- Provide for coordination of Project Impact.

- Provide coordination for Comprehensive Multi-hazard Mitigation Plan development, implementation, and monitoring.
- Provide for interagency coordination
- Provide development of procedures for grant administration and project evaluation.
- Provide State Hazard Mitigation Team assistance to local governments.
- Provide for development of specific hazard mitigation plans, such as drought and wildfire.
- Provide for local hazard and risk analysis.
- Provide for development of SHMT mitigation recommendations following disasters.

Utah Department of Agriculture

The Utah Department of Agriculture administers programs serving the state's large agricultural sector. The department's response role during and after a disaster period has been to coordinate damage reports for funding needs and provide loan and recovery program information and assistance to disaster victims. This service is provided for flood, drought, insect infestation, fire, livestock disease, and frost.

Assistance During Drought Disasters:

A damage reporting network coordinated through the existing County Emergency Board was established during the drought disaster of 1996. Each county agent assembled damage reports in his area and transmitted them through a computer network based at Utah State University. The individual damage reports from each county were recapped in the Department of Agriculture and formed the basis of documentation for an appeal to the legislature for additional funds to mitigate the damage.

Loans Handbook
The department has prepared a handbook listing the types of loans available for flood damage to agriculture, the funding requirements, and applications procedures. This includes loans from both state and federal sources. There are three loan programs operated by the agriculture department, all of which can be used for flood damage: 1) Rural Rehabilitation Loan Program (federally funded and operated by the state); 2) Agriculture Resource Development Loan Program (state funded); and 3) Emergency Loan Program (state funded).

Soil Conservation Program
The Department of Agriculture also administers the ongoing Soil Conservation Program. In each of the state's thirty-nine soil conservation districts, three unpaid, elected supervisors offer technical assistance and consultation on watershed protection. The state offers limited technical and planning assistance through a staff member. The program works cooperatively with the federal Soil Conservation Service which provides most of the technical assistance. The ongoing program is not regulatory, but is directed at improved water use and soil conservation.

Disaster Easements:
Because of the similarity between past events the department in now working on a permanent hazard mitigation concept known as "Disaster Easements", which may have widespread agreements with irrigation companies, water districts, or water users associations for the purpose of routing flood water through town.

Monitoring Ground Water Quality:
The Department also monitors groundwater quality of private individuals wells and springs throughout the State.

Non-Point Source Pollution:
The Departments Non-Point Source Pollution Program focuses on flood prevention through reduction of erosion, vegetating streams, and restoring "natural stream structure" The Department also monitors drought conditions, which are a precursor to wildfire.

Department of Community and Economic Development

Community Impact Board
The Utah Permanent Community Impact Fund Board provides loans and/or grants to state agencies and sub-divisions of the state, which may be socially or economically impacted by mineral resource development of federal lands.

Permanent Community Impact Fund:
The Permanent Community Impact Fund provides loans and/or grants to state agencies and subdivisions of the state, which are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands.

Under the Federal Mineral Lease Act of 1920, leaseholders on public land make royalty payments to the federal government for the development and production of non-metalliferous minerals. In Utah, the primary source of these royalties is the commercial production of fossil fuels on federal land held by the U.S. Forest Service and the Bureau of Land Management. Since the enactment f the Minerals Lease Act of 1920, a portion of these royalty payments, called mineral lease payments, have been returned to the state in an effort to help mitigate the local impact of energy and mineral developments on federal lands.

Funding Options:
The Board has the option of funding projects with loans and/or grants. The Board's preferred financing mechanism is an interest-bearing loan.

Loan Requirements:
In providing financial assistance in the form of a loan, the Board may purchase an applicant's bonds only if the bonds are accompanied by legal opinion of recognized municipal bond counsel to the effect that the bonds are legal and binding under applicable Utah Law.

The Board may purchase either a taxable or tax-exempt bond. The board may purchase taxable bonds if it determines, after evaluating all relevant circumstances, including the applicant's ability to pay, that the purchase of the taxable bonds is in the best interest of the state and the applicant.

Grants
Grants may be provided only when the other financing mechanisms cannot be utilized, where no reasonable method of repayment can be identified, or in emergency situations regarding public health and/or safety.

Community Development Block Grant:
The Community Development Block Grant, or CDBG program, provides funding from the federal government's Department of Housing and Urban Development or HUD, to small cities and counties in the State of Utah.

Utah Division of State History

The Utah State Historical Society, Utah's Division of State History, was founded in 1897 on the 50th anniversary of the first settlement in the Salt Lake Valley by the Mormon Pioneers. The Society became a state agency in 1917, now housed in the historic Rio Grande Depot since 1980. The Division stimulates archaeological research, study; oversees the protection and orderly development of sites; collects and preserves specimens; administers site surveys; keeps excavation records; encourage and supports the preservation of historic and pre-historic sites and publishes antiquities records. The Division also issues archaeological permits and consults with agencies and individuals doing archaeological work.

Preserving and Sharing Utah's Past
The mission of the State Division of History is "preserving and sharing Utah's past for the present and the future."

State Historical Preservation Officer (SHPO)
The SHPO administers the Section 106 process (national Historic Preservation Act) in Utah. The SHPO also serves on the Utah State Hazard Mitigation Team, providing guidance on historical and cultural preservation regulations.

Historic properties include districts, buildings, structures, objects, landscapes, archeological sites, and traditional cultural properties that are included in, or eligible for inclusion in, the National Register of Historic Places. These properties are not just "old buildings" or "well-known historic sites, but places important in local, state, or national history. Facilities as diverse as bridges and water treatment plants my, be considered historic.

Utah Geological Survey (UGS)

The Utah Geologic and Mineral Survey is the principal state agency concerned with geologic hazards. Through years of study, the UGS has developed considerable information on Utah's geologic hazards. When geologic events occur or threaten to occur, the UGS is consulted by other state agencies, local governments, and private organizations for assistance in defining the threat from natural hazards. The UGS works in partnership with other agencies, such as DESHS, in relating the threats from natural hazard to the communities at risk.

Functions:
The functions of the UGS include the following:
Evaluation of individual geological hazards;
Participation on local government and state agency technical teams;
Prediction of the performance on individual slides once they began to move;
Coordination and awareness of research efforts undertaken by other agencies;
Provide information on status of individual geologic hazards;
Reconnaissance reports on status of hazards statewide;
Advise Division of Water Rights on geologic hazards associated with dam sites; and
Provide geologic information for use during planning of remedial actions.

Laws/authorities/policies of the Utah Geological Survey for conducting mitigation

Utah Code Annotated
Chapter 73 Geological and Mineral Survey
Section 68-73-6 Objectives of Survey

(e) Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of this state; (f) assist local and state government agencies in their planning, zoning, and building regulations functions by publishing maps, delineating appropriately wide special earthquake risk areas, and, at the request of state agencies, review the siting of critical facilities:
Utah State Office of Education (USOE) Rule R277-455 Standards and Procedures for building plan review

R277-455-4 Criteria for Approval

To receive approval of a proposed building site, the local school district must certify that:
Staff of the Utah Geologic Survey have reviewed and recommended approval of the geologic hazards report provided by the school districts geotechnical consultant.
Division of Water Resources
Mitigation Functions
The Divisions role of planning, funding and constructing water projects serves as both active and passive hazard mitigation against drought and flood situations throughout the state. The various State water plans contain brief summaries of flood threat and risk for each drainages.

The Division is one of seven agencies in the State Department of Natural Resources. The eight member Water Resources Board, appointed by the governor, administers three state water conservation and development funds. They are:
Revolving Construction fund – This fund started in 1947 with 1 million legislative appropriation to help construct irrigation projects, wells and rural culinary water systems. Further appropriations have added to this fund.
Conservation and Development Fund – This fund was created in 1978 wit the sale of 25 million in general obligations bonds. Money was added to this fund with bond sales in 1980 and 1983. The C & D Fund generally helps sponsors finance larger multi-purpose dams and water systems.
Cities Water Loan Fund – Established with an initial legislative appropriation of 2 million dollars in 1974, and with continued appropriations, this fund provides financing to help construct new culinary water projects for cities, towns, improvement districts, and special service districts.

Construction Funds: In addition to overseeing these three construction funds, the Division also manages the State funds appropriated each year for renovation and reconstruction of unsafe dams. As the funding arm of the state for water resource projects the Division works closely with Water Rights, the Regulatory arm of the state charged with jurisdiction over all private and state owned dams.

Water Resource Planning: The Division is also charged with the general water resource planning for the state. The State Water Plan is a process that is coordinated to evaluate existing water resources in the state, determine water-related issues that should be confronted and recommend how and by whom issues can be resolved. The plan identifies programs and practices of state and federal agencies, water user groups and environmental interests and describes the state's current, future, and long-term water related needs. The plan is continually updated using current hydrologic databases, river basin simulations, water supply and demand models and water related land use inventories. Revisions reflect the latest water conservation and development options concerning water rights, water transfers, population, zoning, and many other complex issues for the next 50 years in the state's major river basins.

Utah Division of Forestry, Fire, and State Lands

The Division of Forestry, Fire & State Lands utilizes the principles of stewardship and ecosystem management to assist non-federal landowners in management of their natural resources. The agency provides wildland fire protection for non-federal landowners commensurate with risk; and optimizes the benefits from ecosystem based, multiple-use management of resources held in the public trust. Wildfires are managed from six area offices 1) Bear River Office, 2) Northeast Area, 3)Wasatch Front Area, 4) Central Area, 5) Southwest Area, and 5) Southeast Area.

The Division operates under the authority of the Utah Code Annotated 65-A-3-1 though 10.

The Flame-n-Go's (pronounced Flamingoes): In 1978 the Division of Forestry, Fire, and State Lands and the Utah State Prison signed a cooperative agreement establishing Utah's first volunteer, inmate wildland fire hand-crew. The inmates named themselves the "Flame-N-Go's" and designed a logo that has become well known in the wildland fire fighting community.

All Flame-N-Go's are carefully screened for the program. They must complete rigorous training and sign a yearly contract committing themselves to preserving Utah's natural resources and building responsible lives.

The Flame-N-Go's are divided into three crews, each of which can respond to fires anywhere in the United States. A twenty-man type II handline crew is the backbone of the group, responding to each assignment with all tools and equipment needed to do battle on the fireline. An Engine Strike Team, (five fire engines, outfitted with men and equipment) is ready to respond when needed as an Engine Strike Team or a Type II Handline Crew. The Hotshot crew is trained to tackle the most dangerous fires in the most rugged terrain. All crews during peak fire season are on 24-hour call to respond within an hour's notice. These crews respond to an average of 50 fires per year and typically spend 45,000 hours fighting fires each season. At least one Division of Forestry, Fire, and State Lands supervisor and two Department of Corrections staff accompany each crew.

Each year, Flame-N-Go's are put through at least 80 hours of extensive training including classroom work and practical field exercises. Safety, individual, and team skills, and professionalism are stressed.

National Fire Plan: The Division administers the State responsibilities of the National fire Plan, a current emphasis of the U.S. Congress, which also addresses hazard and risk analysis and hazard mitigation.

Living With Fire Committee: The Division works in partnership with the U.S. Forest Service, Bureau of Land Management, and various other entities tasked with suppressing wildland fires on the "Living With Fire" program promoting wildland fire mitigation.

Utah Division of State Parks and Recreation

The goal of the Division of Parks and Recreation is to enhance the quality of life for residents and visitors of our state through parks, people, and programs. They are responsible for protecting, preserving, and managing many of Utah's natural and heritage resources.

Hazard and Risk Analyses: The Division develops hazard and risk analyses for the State Parks as part of the park resource management plans. The Utah Division of Emergency Services and Homeland Security produced one analysis for Snow Canyon State Park in Washington County.

Non-Motorized Trail Program: The Recreational Trails Act of 1991 charged Utah State Parks and Recreation with coordinating the development of a statewide network of non-motorized trails. The Non-Motorized Trail program makes state and federal funds available on a 50/50 matching basis to any federal, state, or local government agency, or special improvement district for the planning, acquisition, and development of recreational trails.

Grants from State Parks Boards: The council advises the Division of Parks and Recreation on non-motorized trail matters, reviews requests for matching grant fiscal assistance, rates and ranks proposed trail projects and along with State Park's staff provides recommendations for funding to the State Parks Board.

Riverway Enhancement Program: In 1986, the Utah Legislature passed a bill which established the Riverway Enhancement Program. The program makes state funds available on a 50/50 matching basis to state agencies, counties, cities, towns, and/or special improvement districts for property acquisition and/or development for recreation, flood control, conservation, and wildlife management, along rivers and streams that are impacted by high density populations or are prone to flooding. Public outdoor recreation should be the primary focus of the project.

Utah Division of Water Rights

The Division of Water Rights is the state agency that regulated appropriation and distribution of water in the State of Utah. It is an office of public record. The Utah State Engineer's Office was created in 1897. The State Engineer's Office is the chief water rights administrative officer. A complete "water code" was enacted in 1903 and was revised and reenacted in 1919. This law, with succeeding complete reenactments of State statutes, and as amended, is presently in force mostly as *Utah Code, Title 73*. In 1963, the name was changed from State Engineers office to the Division of Water Rights.

All water in Utah are public property. A water right is a right to the use of water based upon 1) quantity, 2) source, 3) priority date, 4) nature of use, 5) point of diversion, and 6) physically putting water to beneficial use.

Regulate Dams: The State engineer has the authority to regulate dams for the purpose of protecting public safety. Dams are classified according to hazard, size, and use. The dam inventory gives the identification, location, construction parameters, and the operation and maintenance history of the dams in Utah.

Stream Alterations Program: The Utah state Engineer's Office administers a Stream alterations program with the purpose of regulation activities affecting the bed or banks or natural streams. The State Engineer's working definition of a natural stream is any natural waterway in the state, which has flows of sufficient duration to develop a characteristic ecosystem distinguishing it from the surrounding

environments. Any individual planning an activity that will affect a natural stream must first obtain a Stream Alterations Permit from this office.

Most proposals reviewed by the State, are covered by General Permit 40, which authorizes the state to have its Stream Alteration Permit fulfill the requirements of Section 404 of the Clean Water Act for most activities. General permit 40 does not apply in some instances and a U.S. Army Corps of Engineers Individual Permit is required. Projects requiring this additional permit include those involving wetlands, threatened or endangered species, properties listed on the National Historic Register, stream relocation, or the pushing of streambed material against a stream bank.

Dam Safety Program: The Dam Safety Section of the Division of Water Rights was established under Chapters 73-5a 101 thru 73-5a 702 including chapters 73-2-22 for Flood Control and the Chapter 63-30-10 Waiver of Immunity of the Utah Code and Rules R655-10 thru R655-12-6A. The program basically has jurisdiction over all private and state owned dams in the state during design, construction, operation, and decommissioning. This involved periodic inspections according to hazard classifications, inventory maintenance, design, and construction approval and systematic upgrade of all the high hazard structures to current dam safety Minimum Standards and creation of Emergency Action Plans for High Hazard dams. Since 1991, detailed dam reviews have been undertaken by the staff and by private consulting firms. Since 1995, the State Legislature has provided 3-4 million dollars per year to finance 50 % of the instrumentation, investigations, and design and 80 to 90 % of the construction costs of retrofitting and upgrading deficient dams, starting with the worst dams in the most hazardous locations.

The impetus for this dam safety program has been in reaction to dam failures, both in Utah and in other states, including the Teton Dam in Idaho and the Trial Lake Dam in Summit County and the Quail Creek Dam near St. George Utah. Since the establishment of our Minimum Standards program we have fostered the repair of dozens of dams and have not had a catastrophic failure since.

Future recommendations include continuation of the funding for dam upgrades for all the high hazard dams, and then the moderate hazard dams, continued annual inspections for maintenance items and dangerous deficiencies, upgrading EAP, and hazard assessment to reflect downstream development. Inclusion of the scanned design drawings and inundation maps from the EAP studies is being considered for our web page for public information and emergency access. Possible expansion of the program to cover canals and dikes has been considered.

Utah Division of Wildlife Resources

It is the mission of the Utah Division of Wildlife Resources to serve people of Utah as trustee and guardian of the State's wildlife. Regulates hunting, fishing and trapping, and promotes recreational, educational, scientific and aesthetic enjoyment of wildlife.

Wildlife Habitats and Hazards: Wildlife species and/or their habitats are frequently exposed to hazards. These may be either natural or human influenced (i.e. drought, flood, fire, wind, snow, wetland drainage, water diversions, hazardous material spills, improper/illegal chemical use, earthquake, and other land or water construction/development). Impact resulting either directly or indirectly, from individuals or an accumulation of several hazards, may cause but not be limited to: decreased water supply, stream/lake channel/basin morphology change, riparian/upland vegetation loss or degradation, and impairment of water quality. These in turn have a varying influence, in the extreme causing death or at a minimum temporary stress, on wildlife populations and their habitats. Hazards mentioned may affect a fairly large geographic area or be very localized in nature.

While the Division of Wildlife Resources (DNR) is charged with the management of wildlife, they do not have regulatory authority over water appropriations, water quality, development, or land management; except as allowed or occurring on properties they own. Therefore, when hazards occur, outside DWR property, DWR is limited to be a participating influence only through comments to the other regulatory agencies or individuals.

DWR management of wildlife is carried out largely through regulation of taking controlling, disturbance and/or possession of wildlife, and introduction of movement of species. However, there are numerous non-regulatory means (i.e. conservation agreements, memorandum of understanding, contract, lease agreements, cooperative agreements, and technical assistance) by which DWR interacts with other agencies, groups and individuals, to have an influence on wildlife and/or their habitat.

Hazard Areas of Commentary Interaction
While not being able to control/regulate many of the elements necessary for the benefit of wildlife; DWR provides technical comments for the maintenance, protection, and enhancement of wildlife and/or habitats for various value reasons. It is too extensive list all the areas of comment; however, the following are examples of fairly frequent concern:

- Steam Channel Alteration Permit Applications
- Water Rights Filings
- Energy and Mineral Exploration and Extraction Applications
- Federal Agency land management plans
- Waste Water Discharge Permit Applications
- Hydroelectric plant licensing or regimenting
- Urban and rural development project planning
- Utility transmission line style and locations
- Wetland alteration
- Federal land management planning
- Highway constructions

The Utah Division of Drinking Water

Division of Drinking Water's Mission Statement is to " protect the public against waterborne heath risks through assistance, educations, and oversight". The Division acts as the administrative arm of the Utah Drinking Water Board. It implements the rules, which they adopt. As such, it is engaged in a variety of activities related to the design and operation of Utah's public drinking water system. The Utah Drinking Water Board is an 11-person board appointed by the Governor. It is empowered by Title 19, Chapter 4 of the Utah Code to adopt rules governing the design, operations, and maintenance of Utah's "public drinking water system".

Safe Drinking Water Act: There is a Federal Safe Drinking Water Act which applies to all public drinking water systems in the country. The U.S. Environmental Protection Agency (EPA) has given Utah "primacy" for enforcing the federal act within its boundaries. To qualifiy for this Utah's laws and rules governing public drinking water systems must be at least as strict as the federal law.

Sanitary Surveys: The Division performs sanitary surveys on the water systems, which is a compliance action that identifies system deficiencies.

Emergency Response Plans: The Division of Drinking Water requires water utilities to prepare emergency response plans under the State Safe Drinking Water Act, Utah Code Section 19-4. The Division operates according to DDW Rules: R309 gives them authority to administer actions: R309-301 through R309-104 and R309-113, R309-150, R309-301, and R309-211.

Utah Division of Solid and Hazardous Waste

The Tier II Chemical Inventory report, required by the Federal Emergency Planning and community Right-to-Know Act, requires facilities to submit lists of hazardous chemicals present on site. These reports are computerized and the information is provided to local emergency planning committees, the general public, and others for contingency planning purposes. To implement the Federal law, the State operates under Utah State Code, Section 63-5-5. The Division of Solid and Hazardous Waste requires that hazardous waste treatment storage and disposal facilities prepare and emergency response plan as required by regulations authorized by the State Solid and Hazardous Waste Act, Utah Code Section 19-6.

Other Agency programs are regulatory in nature requiring proper use or disposal of hazardous substances or pollutants. For example the Division of Solid and Hazardous Waste regulates the disposal of hazardous waste, the Division of Radiation Control regulates the proper usage and disposal of radioactive materials. As such there is a threat mitigation nature to these programs.
Utah Division of Water Quality

The Utah Division of Water Quality protects, maintains, and enhances the quality of Utah's surface and underground water for appropriate beneficial uses; the Division of Water Quality regulates discharge of pollutants into surface water, and protects the public health through eliminating and preventing water related health hazards which can occur as a result of improper disposal of human, animal, or industrial wastes while giving reasonable consideration to the economic impact.

Water Quality Fund and Wastewater Treatment Project Fund: The Division Manages the Water Quality Revolving Fund that can be used by local governments for water quality projects and a Wastewater Treatment Project Fund.

Abating Watershed Pollution: Federal and State regulations charge the Division with "preventing, controlling, and abating" watershed pollution. Other state and local agencies have similar responsibilities.

The Watershed Approach forms partnerships with these groups to pool resources and increase the effectiveness of existing programs. For each watershed management unit, a watershed plan will be prepared. The watershed plan addresses management actions at several spatial scales ranging from those that encompass a watershed management unit to specific sites that are tailored to specific environmental conditions. Ground water hydrologic basins and eco-region areas encompassed within the units will also be delineated.

State Revolving Fund Program: In 1987, Congress replaced the Construction Grants Program, with the State Revolving Fund Program. Rather than provide direct grants to communities, the federal government provides each state with a series of grants, then each state contributes a 20 percent state match. Grants from the federal government are combined with state funds in the Water Quality Project Assistance Program (WQPAP) and are used to capitalize a perpetual source of funds to finance water quality construction control activities at below market interests rates. Projects eligible for WQPAP financing include such traditional activities as construction of wastewater treatment plants and sewers. The program also will finance non-traditional water quality-related activities such as agricultural runoff control, landfill closures, contaminated industrial property (Brownfield) remediation, stream bank restoration, and wellhead protection.

Appendix

The following table list critical facilities, which may be affected by hazards

Table A-1

NAME	ADDRESS	CITY	DESC_	Dam Failure	Landslide	Flood	Wild Fire	Wetland	Liqufaction
Treasure Mt Middle	2530 Kearns Blvd, Park City 84	Park City	SCHOOL	0	0	0	1	0	0
North Fork Fire Station	8838 N Alpine Loop Rd.	Sundance	Fire Station	0	0	0	1	0	0
SUMMITT COUNTY SHERIFFS OFC			police station	0	0	0	1	0	0
Alpine Fire Department	20 N Main	Alpine	Fire Station	0	0	0	0	0	0
Alpine City Hall	20 N Main	Alpine	Government	0	0	0	0	0	0
Alpine School	400 E 300 N, Alpine 84004	Alpine	SCHOOL	0	0	0	0	0	0
LONE PEAK FIRE STATION		Alpine	Fire Station	0	0	0	0	0	0
National Guard Armory	251 S 200 East	American Fork	Government	0	0	0	0	0	1
Greenwood School	50 E 200 S, American Fork 8400	American Fork	SCHOOL	0	0	0	0	0	1
American Fork City Hall	31 N. Church	American Fork	Government	0	0	0	0	0	0
American Fork Hospital	170 N 1100 East	American Fork	Hospital	0	0	0	0	0	0
American Fork Ambulance Office	96 N Center	American Fork	Ambulance	0	0	0	0	0	0
American Fork Fire Department	98 N Center	American Fork	Fire Station	0	0	0	0	0	0
Barratt School	168 N 900 E, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
Forbes School	281 N 200 E, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
Legacy School	28 E 1340 N, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
Shelley School	550 N 200 W, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
American Fork Junior High	20 W 1120 N, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
American Fork High	510 N 600 E, American Fork 840	American Fork	SCHOOL	0	0	0	0	0	0
Dan W Peterson School	169 N 1100 E, American Fork 84	American Fork	SCHOOL	0	0	0	0	0	0
Ensign School	215 N Center, American Fork 84	American Fork	SCHOOL	0	0	0	0	0	0
Cedar Fort Town Hall	173 N Church	Cedar Fort	Government	0	0	0	0	0	0
Cedar Valley School	40 E Center, Cedar Fort 84013	Cedar Fort	SCHOOL	0	0	0	0	0	0
CEDAR FORT FIRE DEPT		Cedar Fort	Fire Station	0	0	0	0	0	0
Cedar Hills Town Office	4393 W Cedar Hills Dr.	Cedar Hills	Government	0	0	0	0	0	0
Cedar Ridge School	4501 W Cedar Hills Dr, Cedar H	Cedar Hills	SCHOOL	0	0	0	0	0	0
CEDAR HILLS FIRE DEPT		Cedar Hills	Fire Station	0	0	0	0	0	0
North Summit School	Box 497, 240 S Beacon Dr, Coal	Coalville	SCHOOL	0	0	0	0	0	0

North Summit Middle	Box 497, 76 S 100 E, Coalville	Coalville	SCHOOL	0	0	0	0	0	0
North Summit High	Box 497, 53 S 100 E, Coalville	Coalville	SCHOOL	0	0	0	0	0	0
COALVILLE FIRE DEPT		Coalville	Fire Station	0	0	0	0	0	0
Eagle Mountain City Offices	1700 Eagle Mountain Blvd	Eagle Mountain	Government	0	0	0	0	0	0
Eagle Mountain Fire Department	1700 Eagle Mountain Blvd	Eagle Mountain	Fire Station	0	0	0	0	0	0
Elk Ridge City Offices	80 Park Dr.	Elk Ridge	Government	0	0	0	0	0	0
Elk Ridge Fire Department	80 Park Dr	Elk Ridge	Fire Station	0	0	0	0	0	0
Genola City Offices	74 W. 800 South	Genola	Government	0	0	0	0	0	1
GENOLA FIRE DEPT		Genola	Fire Station	0	0	0	0	0	1
Goshen City Offices	12 W Main	Goshen	Government	0	0	0	0	0	1
Goshen School	PO Box B, 60 N Center, Goshen	Goshen	SCHOOL	0	0	0	0	0	1
GOSHEN FIRE DEPT		Goshen	Fire Station	0	0	0	0	0	1
WASATCH COUNTY FIRE DEPT		Heber	Fire Station	0	0	0	0	0	0
Heber Valley School	730 S 600 W, Heber City 84032	Heber City	SCHOOL	0	0	0	0	0	0
J R Smith School	235 E 500 N, Heber City 84032	Heber City	SCHOOL	0	0	0	0	0	0
Wasatch Middle	200 E 800 S, Heber City 84032	Heber City	SCHOOL	0	0	0	0	0	0
Wasatch High	64 E 600 S, Heber City 84032	Heber City	SCHOOL	0	0	0	0	0	0
Wasatch Alter High	301 S Main, Heber City 84032	Heber City	SCHOOL	0	0	0	0	0	0
HENEFER FIRE DEPT		Henefer	Fire Station	0	0	0	0	0	0
Highland City Offices	5378 W 10400 North	Highland	Government	0	0	0	0	0	0
Highland School	10865 N 6000 W, Highland	Highland	SCHOOL	0	0	0	0	0	0
Mt Ridge Junior High	5500 W 10400 N, Highland	Highland	SCHOOL	0	0	0	0	0	0
Lone Peak High	10189 N 4800 W, Highland 84003	Highland	SCHOOL	0	0	0	0	0	0
South Summit School	535 E 300 S, Kamas 84036	Kamas	SCHOOL	0	0	0	0	0	0
South Summit Middle	355 E 300 S, Kamas 84036	Kamas	SCHOOL	0	0	0	0	0	0
South Summit High	45 S 300 E, Kamas 84036	Kamas	SCHOOL	0	0	0	0	0	0
SOUTH SUMMIT FIRE DEPT		Kamas	Fire Station	0	0	0	0	0	0
Lehi School	765 N Center, Lehi 84043	Lehi	SCHOOL	0	0	1	0	0	1
Lehi City Fire Department	176 N Center	Lehi	Fire Station	0	0	0	0	0	1
Lehi City Hall	153 N 100 East	Lehi	Government	0	0	0	0	0	1
National Guard Armory	348 E Main	Lehi	Government	0	0	0	0	0	1
Eaglecrest School	2760 N 300 W, Lehi 84043	Lehi	SCHOOL	0	0	0	0	0	1

Meadow School	176 S 500 W, Lehi 84043	Lehi	SCHOOL	0	0	0	0	0	1
Lehi High	180 N 500 E, Lehi 84043	Lehi	SCHOOL	0	0	0	0	0	1
Sego Lily School	550 E 900 N, Lehi 84043	Lehi	SCHOOL	0	0	1	0	0	0
Lehi Junior High	700 E Cedar Hollow Rd, Lehi 84	Lehi	SCHOOL	0	0	0	0	0	0
U. S. B. O. R. Field Materials Control Lab	3979 W 5600 North	Lindon	Government	0	0	0	0	0	1
Oak Canyon Junior High	750 E 200 S, Lindon 84042	Lindon	SCHOOL	0	0	0	0	0	1
Lindon City Center	100 N State	Lindon	Government	0	0	1	0	0	0
Lindon Ambulance Office	100 N State	Lindon	Ambulance	0	0	0	0	0	0
Lindon Fire Department	100 N State	Lindon	Fire Station	0	0	0	0	0	0
Lindon School	30 N Main, Lindon 84042	Lindon	SCHOOL	0	0	0	0	0	0
Rocky Mt. School	55 S 500 E, Lindon 84042	Lindon	SCHOOL	0	0	0	0	0	0
Mapleton Fire Department	35 E Maple	Mapleton	Fire Station	0	0	0	0	0	1
Mapleton City Offices	35 E Maple	Mapleton	Government	0	0	0	0	0	1
Mapleton Ambulance Office	35 E Maple	Mapleton	Ambulance	0	0	0	0	0	1
Mapleton School	120 W Maple, Mapleton 84664	Mapleton	SCHOOL	0	0	0	0	0	1
MAPLETON FIRE DEPT		Mapleton	Fire Station	0	0	0	0	0	1
Midway School	225 S 100 E, Midway 84049	Midway	SCHOOL	0	0	0	0	0	0
OAKLEY FIRE DEPT		Oakley	Fire Station	0	0	0	0	0	0
Vineyard School	950 W 800 S, Orem 84058	Orem	SCHOOL	1	0	0	0	0	1
Orem Community Hospital	331 N 400 West	Orem	Hospital	1	0	0	0	0	0
Orem City Ambulance Office #2	911 N Main St.	Orem	Ambulance	1	0	0	0	0	0
Orem City Hall	56 N. State	Orem	Government	1	0	0	0	0	0
Orem City Fire Station #2	911 N Main St.	Orem	Fire Station	1	0	0	0	0	0
Cascade School	160 N 800 E, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Geneva School	400 N 665 W, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Orem School	450 W 400 S, Orem 84058	Orem	SCHOOL	1	0	0	0	0	0
Scera Park School	450 S 400 E, Orem 84058	Orem	SCHOOL	1	0	0	0	0	0
Sharon School	525 N 400 E, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Suncrest School	668 W 150 N, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Canyon View Junior High	625 E 950 N, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Lakeridge Junior High	951 S 400 W, Orem 84058	Orem	SCHOOL	1	0	0	0	0	0
Orem Junior High	765 N 600 W, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0

Mountain View High	665 W Center, Orem 84058	Orem	SCHOOL	1	0	0	0	0	0
Orem High	175 S 400 E, Orem 84057	Orem	SCHOOL	1	0	0	0	0	0
Columbia Timpanogos Regional Hospital	750 W 800 North	Orem	Hospital	0	0	0	0	0	0
Orem City Fire Station #3	275 N 1200 West	Orem	Fire Station	0	0	0	0	0	0
Orem City Ambulance Office #3	275 N 1200 West	Orem	Ambulance	0	0	0	0	0	0
Orem City Ambulance Office #1	300 E 1000 South	Orem	Ambulance	0	0	0	0	0	0
Orem City Fire Station #1	300 E 1000 South	Orem	Fire Station	0	0	0	0	0	0
Aspen School	945 W 2000 N, Orem 84057	Orem	SCHOOL	0	0	0	0	0	0
Cherry Hill School	250 E 1650 S, Orem 84058	Orem	SCHOOL	0	0	0	0	0	0
Hillcrest School	651 E 1400 S, Orem 84058	Orem	SCHOOL	0	0	0	0	0	0
Orchard School	1035 N 800 E, Orem 84057	Orem	SCHOOL	0	0	0	0	0	0
Northridge School	1660 N 50 E, Orem 84057	Orem	SCHOOL	0	0	0	0	0	0
Westmore School	1150 S Main, Orem 84058	Orem	SCHOOL	0	0	0	0	0	0
Windsor School	1315 N Main, Orem 84057	Orem	SCHOOL	0	0	0	0	0	0
Timpanogos High	1450 N 200 E, Orem 84057	Orem	SCHOOL	0	0	0	0	0	0
Ecker Hill Middle	2465 W Kilby, Park City 84098	Park City	SCHOOL	0	0	0	0	0	0
Park City High	1750 Kearns Blvd, Park City 84	Park City	SCHOOL	0	0	0	0	0	0
PARK CITY FIRE DISTRICT STN 31		Park City	Fire Station	0	0	0	0	0	0
PARK CITY FIRE DISTRICT STN 32		Park City	Fire Station	0	0	0	0	0	0
PARK CITY FIRE DISTRICT STN 33		Park City	Fire Station	0	0	0	0	0	0
Payson City Offices	425 W Utah Ave	Payson	Government	0	0	0	0	0	1
Taylor School	40 S 500 W, Payson 84651	Payson	SCHOOL	0	0	0	0	0	1
Wilson School	590 W 500 S, Payson 84651	Payson	SCHOOL	0	0	0	0	0	1
Payson Fire Department	45 E 100 South	Payson	Fire Station	0	0	1	0	0	0
Parkview School	360 S 100 E, Payson 84651	Payson	SCHOOL	0	0	1	0	0	0
Columbia Mountain View Hospital	1000 E Hwy 198	Payson	Hospital	0	0	0	0	0	0
Payson Ambulance Office	388 E 100 North	Payson	Ambulance	0	0	0	0	0	0
Barnett School	333 E 400 N, Payson 84651	Payson	SCHOOL	0	0	0	0	0	0
Payson Middle	851 W 450 S, Payson 84651	Payson	SCHOOL	0	0	0	0	0	0
Payson Junior High	1025 S Highway 6, Payson 84651	Payson	SCHOOL	0	0	0	0	0	0
Payson High	1050 S Main, Payson 84651	Payson	SCHOOL	0	0	0	0	0	0
U. S. B. O. R. Regional Drill Shop	315 W 1100 North	Pleasant Grove	Government	0	0	0	0	0	0

Pleasant Grove City Hall	70 S 100 East	Pleasant Grove	Government	0	0	0	0	0	0
Pleasant Grove Ambulance Office	110 S 100 East	Pleasant Grove	Ambulance	0	0	0	0	0	0
Pleasant Grove Fire Department	110 S 100 East	Pleasant Grove	Fire Station	0	0	0	0	0	0
Central School	95 N 400 E, Pleasant Grove 840	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Grovecrest School	200 E 1100 N, Pleasant Grove 8	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Manila School	1726 N 600 W, Pleasant Grove 8	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Valley View School	941 Orchard Dr, Pleasant Grove	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Pleasant Grove Junior High	810 N 100 E, Pleasant Grove 84	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Pleasant Grove High	700 E 200 S, Pleasant Grove 84	Pleasant Grove	SCHOOL	0	0	0	0	0	0
American Heritage	125 N 100 E, Pleasant Grove 84	Pleasant Grove	SCHOOL	0	0	0	0	0	0
Elementary School	600 N 1300 W, Pleasant View 84	Pleasant View	SCHOOL	0	0	0	0	0	1
Utah Valley Regional Medical Center	1034 N 500 West	Provo	Hospital	1	0	0	0	0	1
Utah County Offices	100 E Center	Provo	Government	1	0	0	0	0	1
Provo City Hall	351 W Center	Provo	Government	1	0	0	0	0	1
Provo City Electric Energy Department	251 W 800 North	Provo	Government	1	0	0	0	0	1
Provo Ambulance Office #3	601 W Columbia Ln	Provo	Ambulance	1	0	0	0	0	1
Provo Fire Station #4	2050 W 95 South	Provo	Fire Station	1	0	0	0	0	1
Provo City Ambulance Dept Station #4	2050 W 95 South	Provo	Ambulance	1	0	0	0	0	1
Provo Fire Station #3	601 W Columbia Ln	Provo	Fire Station	1	0	0	0	0	1
National Guard Armory	222 W 500 North	Provo	Government	1	0	0	0	0	1
Provo Fire Station #1	80 S 300 West	Provo	Fire Station	1	0	0	0	0	1
Provo City Ambulance Office #1	80 S 300 West	Provo	Ambulance	1	0	0	0	0	1
Valley Ambulance	925 N 500 West	Provo	Ambulance	1	0	0	0	0	1
Amelia Earhart School	2585 W 200 S, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Franklin School	350 S 600 W, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Sunset View School	525 S 1600 W, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Timpanogos School	449 N 500 W, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Dixon Middle	750 W 200 N, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Farrer Middle	100 N 600 E, Provo 84606	Provo	SCHOOL	1	0	0	0	0	1
Provo High	1125 N University Ave, Provo 8	Provo	SCHOOL	1	0	0	0	0	1
Mt Brook/Eastwood	1300 E Center, Provo 84601	Provo	SCHOOL	1	0	0	0	0	1
Utah County Health Department	589 S State	Provo	Government	0	0	0	0	0	1

Provo City Ambulance Office #2	2737 N Canyon Rd	Provo	Ambulance	0	0	0	0	0	1
Provo Fire Station #2	2737 N Canyon Rd	Provo	Fire Station	0	0	0	0	0	1
Joaquin School	550 N 600 E, Provo 84606	Provo	SCHOOL	0	0	0	0	0	1
Provost School	629 S 1000 E, Provo 84606	Provo	SCHOOL	0	0	0	0	0	1
Westridge School	1720 W 1460 N, Provo 84604	Provo	SCHOOL	0	0	0	0	0	1
Centennial Middle	305 E 2320 N, Provo 84604	Provo	SCHOOL	0	0	0	0	0	1
Canyon Crest School	4664 N Canyon Rd, Provo 84604	Provo	SCHOOL	0	1	0	0	0	0
Rock Canyon School	2405 N 650 E, Provo 84604	Provo	SCHOOL	0	0	0	0	0	0
Wasatch School	1080 N 900 E, Provo 84604	Provo	SCHOOL	0	0	0	0	0	0
Timpview High	3570 N 650 E, Provo 84604	Provo	SCHOOL	0	0	0	0	0	0
Oakridge School	1165 Birch Lane, Provo 84604	Provo	SCHOOL	0	0	0	0	0	0
Salem School	140 W 100 S, Salem 84653	Salem	SCHOOL	0	0	0	0	0	1
Salem City Offices	30 W 100 South	Salem	Government	0	0	0	0	0	0
Salem Ambulance Office	30 W 100 South	Salem	Ambulance	0	0	0	0	0	0
Salem Fire Department	30 W 100 South	Salem	Fire Station	0	0	0	0	0	0
Santaquin City Hall	45 S 100 South	Santaquin	Government	0	0	0	0	0	0
Santaquin Ambulance Office	30 S 100 East	Santaquin	Ambulance	0	0	0	0	0	0
Santaquin Fire Department	30 S 100 East	Santaquin	Fire Station	0	0	0	0	0	0
Santaquin School	25 S 400 W, Santaquin 84655	Santaquin	SCHOOL	0	0	0	0	0	0
SANTAQUIN FIRE DEPT		Santaquin	Fire Station	0	0	0	0	0	0
Saratoga Springs City Offices	6394 S Redwood Rd	Saratoga Springs	Government	0	0	0	0	0	1
Canyon School	1492 E 1240 S, Span Fork 84660	Span Fork	SCHOOL	0	0	0	0	0	0
Brockbank School	340 W 500 N, Spanish Fork 8466	Spanish Fork	SCHOOL	1	0	0	0	0	1
Spanish Fork City Offices	40 S Main	Spanish Fork	Government	0	0	0	0	0	1
Utah County Security Center	3075 N Main St.	Spanish Fork	police station	0	0	0	0	0	1
Spanish Fork Ambulance Station	360 N Main St.	Spanish Fork	Ambulance	0	0	0	0	0	1
Spanish Fork Fire Station	360 N Main St.	Spanish Fork	Fire Station	0	0	0	0	0	1
National Guard Armory	2801 N Main	Spanish Fork	Government	0	0	0	0	0	1
Park School	90 N 600 E, Spanish Fork 84660	Spanish Fork	SCHOOL	0	0	0	0	0	1
Rees School	185 E 400 N, Spanish Fork 8466	Spanish Fork	SCHOOL	0	0	0	0	0	1
Spanish Fork Middle	50 N 900 E, Spanish Fork 84660	Spanish Fork	SCHOOL	0	0	0	0	0	1
Spanish Fork High	99 N 300 W, Spanish Fork 84660	Spanish Fork	SCHOOL	0	0	0	0	0	1

Landmark High (Alt HS)	320 S Main, Spanish Fork 84660	Spanish Fork	SCHOOL	0	0	0	0	0	1
Larsen School	1175 E Flonette Dr, Spanish Fo	Spanish Fork	SCHOOL	0	0	0	0	0	0
Spanish Fork Junior High	600 S 820 E, Spanish Fork 8466	Spanish Fork	SCHOOL	0	0	0	0	0	0
Springville City Hall	50 S Main	Springville	Government	0	0	0	0	0	1
Springville Ambulance Office	45 S Main	Springville	Ambulance	0	0	0	0	0	1
Springville Fire Department	45 S Main	Springville	Fire Station	0	0	0	0	0	1
National Guard Armory	125 S 700 East	Springville	Government	0	0	0	0	0	1
Art City School	121 N 900 E, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Brookside School	750 E 400 S, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Grant School	105 S 400 E, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Sage Creek School	1050 S 700 E, Springville 8466	Springville	SCHOOL	0	0	0	0	0	1
Westside School	570 S Main, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Springville Middle	485 S 100 E, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Springville Junior High	165 S 700 E, Springville 84663	Springville	SCHOOL	0	0	0	0	0	1
Springville High	1205 E 900 S, Springville 8466	Springville	SCHOOL	0	0	0	0	0	1
GENEVA STEEL FIRE DEPT		Vineyard	Fire Station	1	0	0	0	0	1
Geneva Steel Ambulance Office	10 S Geneva Rd	Vineyard	Ambulance	0	0	0	0	0	1
Vineyard City Offices	240 E Gammon	Vineyard	Government	0	0	0	0	0	1
WANSHIP FIRE DEPT		Wanship	Fire Station	0	0	0	0	0	0
WOODLAND FIRE DEPT		Woodland	Fire Station	0	0	0	0	0	0
Woodland Hills Fire Department	Woodland Hills Dr	Woodland Hills	Fire Station	0	1	0	0	0	0
Woodland Hills City Offices	125 E Lakeview Wy	Woodland Hills	Government	0	1	0	0	0	0
PROVO POLICE DEPT			police station	1	0	0	0	0	1
UTAH COUNTY SHERIFFS OFC			police station	1	0	0	0	0	1
Lehi City Ambulance Office	54 N Center		Ambulance	0	0	0	0	0	1
LEHI POLICE DEPT			police station	0	0	0	0	0	1
MAPLETON POLICE DEPT			police station	0	0	0	0	0	1
SPANISH FORK POLICE DEPARTMENT			police station	0	0	0	0	0	1
SPRINGVILLE POLICE DEPT			police station	0	0	0	0	0	1
UTAH COUNTY JUSTICE CENTER			police station	0	0	0	0	0	1
UTAH VALLEY STATE COLLEGE PD			police station	0	0	0	0	0	1
PLEASANT GROVE PD - LINDON			police station	0	0	1	0	0	0

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OREM POLICE DEPT			police station	1	0	0	0	0	0
ALPINE POLICE DEPT			police station	0	0	0	0	0	0
BRIGHAM YOUNG UNIVERSITY PD			police station	0	0	0	0	0	0
HEBER POLICE DEPT			police station	0	0	0	0	0	0
KAMAS POLICE DEPT			police station	0	0	0	0	0	0
PARK CITY POLICE DEPT			police station	0	0	0	0	0	0
PAYSON POLICE DEPT			police station	0	0	0	0	0	0
PLEASANT GROVE POLICE DEPT			police station	0	0	0	0	0	0
SALEM POLICE DEPARTMENT			police station	0	0	0	0	0	0
SANTAQUIN POLICE DEPARTMENT			police station	0	0	0	0	0	0
WASATCH COUNTY HOSPITAL			Hospital	0	0	0	0	0	0
WASATCH COUNTY SHERIFF'S OFC			police station	0	0	0	0	0	0
Park City City Hall			Government	0	0	0	0	0	0
Francis City Hall			Government	0	0	0	0	0	0
KAMAS CITY HALL			Government	0	0	0	0	0	0